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THE profession of architecture in England has lost a most distinguished member in the person of Mr. John Whichcord, recently President of the Royal Institute of British Architects. Mr. Whichcord, as we learn from the *Builder*, was born in Maidstone, in the County of Kent, in 1823. His father was a successful architect in that town, and took his son into his office as a pupil immediately after his graduation from King's College, London. After four years of pupilage, young Whichcord returned to London for study at the Royal Academy, and, soon after, crossed the Channel for an extended tour on the Continent. Naturally of an adventurous disposition, he formed the project, on reaching Constantinople, of going in disguise about the towns of Asiatic Turkey, whose fanatical inhabitants resent so fiercely the intrusion of unbelievers as to make ordinary travelling dangerous. He therefore assumed the dress and manners of an Arab, and attached himself to a tribe, under whose protection he passed through the almost unknown region between the Bosphorus and the Euphrates. Thence he wandered to Syria, and, passing for a Mahometan, was admitted to all the mosques and holy places in Palestine without question. After several years of travel he returned to England, and entered into business, first in partnership with the late Mr. Arthur Ashpitel, and later by himself, constructing in the course of a long and prosperous professional career many important buildings, among them St. Stephen's Club-House at Westminster; the National Safe Deposit Company's building; the Grand Hotel at Brighton, and many banks and mercantile buildings. He found time in the midst of all his business to write a book on the "Polychromy of the Middle Ages," besides several other books, and many papers, on subjects of professional interest; and was an active member of various professional societies. In 1865 he was an unsuccessful candidate for Parliament, and in 1879 was chosen President of the Royal Institute of British Architects. Although he held this office only two years, he did much to maintain and extend the credit of the Institute, and was mainly instrumental in establishing the obligatory examinations which have already proved so valuable to the whole profession.

THE *Hydraulic and Sanitary Plumber* mentions two accidents, very different in character, but both due to the freezing of water in pipes; and at this season, when such freezing is an every-day occurrence, it is well to bear in mind the circumstances under which serious consequences may follow from want of care in dealing with the frozen pipes. In the first case a water-back in a range in the kitchen of the Metropolitan Hotel at Canton, O., exploded suddenly with terrific violence, tearing the range to pieces, and sending fragments of iron through the windows to a distance of several hundred feet, and throwing the cook, who fortunately escaped further injury, across the room. On investigation it was found that the supply-pipes were frozen, and the explosion was due simply to the pressure of the steam generated in the water-back, and unable to escape. We happened ourselves to observe a few weeks ago, a case in which a similar catastrophe, from precisely the same cause, was averted, as it appeared, only by an imperfection in the leather washer of a coupling, which gave way under the pressure, allowing the steam to escape freely enough to prevent further mischief; and every one who uses apparatus of any kind for distributing steam or hot water through pipes from a furnace or other heated point should, if the fire has been allowed to go down in cold weather, make sure before quickening it again that the circulation is unobstructed.

IN the second case, the freezing took place in the drip-pipe attached at a depression in a line of gas-pipe. In very cold weather, especially where the pipes are exposed, a good deal of liquid is condensed from ordinary gas, and settles in the lowest portions of the pipes, often causing the street-lamps and house-lights, beyond the depressed portion, either to go out altogether or to flare up and sink down alternately, as bubbles of gas are forced through the trapping liquid in the mains, to the just annoyance of those who use them. To prevent trouble from this cause, street mains are often provided with small wells at the low points, which collect the liquid, and keep it, out of the way of the gas current, until it can be pumped out, by a pump made for the purpose. For small pipes it is common to employ the simpler device of a drip, or short vertical pipe depending from the low point, with a cock at the bottom to draw off the accumulated liquid from time to time; and, as the condensed liquid is mainly water, such drip-pipes are quite likely to freeze. In this instance the drip, which was on a pipe in a house in Montreal, froze hard enough to burst not only the drip-pipe but the supply-pipe to which it was attached. The gas of course escaped very freely, and an explosion followed immediately upon the arrival of a servant with a candle to investigate the leak.

A SIMPLE device was recently patented for separating the water which first runs from a roof in rains from that which falls afterwards. Every one knows that where rain-water from roofs is collected in cisterns for use, the first few minutes of a shower, particularly after a long drought, give a muddy flow to the cisterns, on account of the mixture with the water of the dust from the roof; so that it is desirable to let the rain which first falls on the roof run to waste, and save only that which comes afterwards. A common way of accomplishing this end is to fit either a movable shoe at the bottom of the leader pipe, or a valve somewhere in its length, by which the current is thrown upon the ground until a change is made in the position of the valve or shoe, by which the water is directed toward the open mouth of the pipe leading to the cistern. The objection to this arrangement is that if the leaders are set to turn the water on the ground, some one must run out in the rain to shift them when the roof has been sufficiently washed; and if they are kept generally turned to flow into the cistern, showers at night may carry a great deal of dirt into the cistern, before those interested in the matter can get out to change them. The patented apparatus, though not quite automatic, has the advantage of not requiring attention while the rain is falling, if its proprietor will think to look after it when each shower is over. In substance, the apparatus consists of a barrel, or some similar receptacle, having a fixed cover, with a floating lid under it. A hole is cut through the upper lid, through which the rain-water passes from the leader; and an overflow-pipe, inserted in the side of the barrel above the fixed cover, extends to the cistern. A waste faucet is placed near the bottom of the barrel. The barrel should always be emptied before the commencement of a shower, and the floating lid will then lie at the bottom, leaving the hole in the cover free for the admission of the rain-water from the leader. The first drops which fall run into the barrel, and as this fills the floating lid rises, until it closes the hole in the fixed cover. The water is then diverted to the cistern, leaving the first flow, containing the washings of the roof, in the barrel, to be drawn off and thrown away at any convenient time.

ACCORDING to the *Architect*, an important series of observations upon dry-rot in timber have been made by a certain Russian professor. The most interesting of his discoveries, which will, we hope, be confirmed by the experience of others, is that a thorough draught of air will destroy the dry-rot fungus within a single day; and that if the exposure to a current of air is accompanied with the sunning of the affected

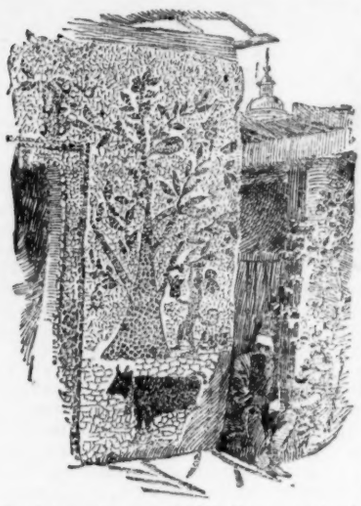
part, the parasite will lose its vitality in a few hours. A strong solution of common salt is extremely efficacious in checking the progress of the disease, as is also a solution of sulphate of copper, or of carbolic acid, or the aromatic tar obtained from birch-wood. The fact of the destruction of the dry-rot fungus by fresh air is of great importance, but it is very desirable that further investigation should show the limitations under which the action takes place. In the pure, though quiet air of the garret of a building with a slated roof we have known dry-rot to flourish and increase, although the place was as free from moisture as a room could well be; and it would be difficult to find a more airy or sunny situation than that of the timbers of a wooden railroad bridge, which are said to rot from the influence of the vapor rising from a stream flowing many feet below. Perhaps the size of the stick may have something to do with the result; and it is well known that the framing of one piece with the end grain in contact with the side of another strongly favors the rotting of both. The whole subject is of extreme importance, and we can hardly imagine any way in which one or two young architects or students could do themselves and the public more service in these dull times than by making a systematic investigation, aided, if possible, by the microscope, of the circumstances under which the dry-rot parasite, the *merulius lacrymans* of the botanists, lives and flourishes, or starves and dies. All the material is at hand in every house. If any one will take the trouble to fill a shallow wooden box to the depth of two inches with earth, making a little hollow in the middle, and will then set the box on the floor, and keep the earth damp by occasional watering, he will soon have an abundant crop of the merulius, which will spread from the wood over the earth on the sides of the little hollow, and will deposit among the particles of earth the tears, or globular clusters of spores, from which the fungus takes its name. With these spores the disease can be communicated, by inoculation, to the object set apart for testing. The infection can also be communicated in a different way, by such contact of a diseased with a sound piece as will allow the delicate threads which run through the substance of the diseased stick, often twenty feet away from the centre of the fungoid growth, to penetrate the sound wood; and a series of experiments should be conducted with reference to each mode of contagion. It would be well, among other tests, to try the effect in checking rot of admitting air to the interior of pieces of wood by boring holes in various directions through them, as is done for the sake of preventing unequal shrinking in oak and other compact woods; and the good or bad result of applying paint to the end of the grain, either by itself or in connection with painting the sides of the stick, should be carefully ascertained. To give an idea of the value of such experiments, intelligently conducted to a practical result, it may be mentioned that the present cost of preparing railway ties to resist dry-rot by the most efficient process now known is from thirty to forty cents each, or about eight hundred dollars for every mile of single track; and a method for preventing or delaying dry-rot as simple as that of admitting air to the interior, if it were found to be effective, would bring a fortune to the inventor, and relief from a serious burden to the stockholders of thousands of miles of railway.

ONE of the most important documents ever contributed to sanitary science has just been issued, in the shape of the final report of the English Royal Commission on Metropolitan Sewage Discharge. The Commission was appointed to inquire into the evils which were said to have attended the discharge of the sewage of London into the Thames, and, if they were found to be serious, to consider the best method of disposing of the sewage in some other way. In the performance of this duty the Commission not only examined the condition of the Thames, and the effect of the sewage in fouling and choking the stream, but studied all the practicable methods of sewage disposal, and its report not only gives a valuable summary of the results now attained in practice by different systems, but the conclusions reached by the Commission are of special weight, as they indicate a conviction that the vast sewage flow of London can be successfully dealt with by methods which have hitherto been applied only on a much smaller scale.

THE opinion of the Commission, as summed up at the end of the report, is that the evils arising from the present system of discharging the London sewage into the Thames, nearly ten miles below the city, are such as "demand a prompt remedy," and it considers the discharge of the sewage of the city in a crude state into any part of the Thames as "neither necessary nor justifiable." To purify the vast mass of liquid, the Commission advises the use of some process of precipitation, which could be applied at the present outfalls. The liquid remaining after the separation of the solids suspended in the sewage might be allowed temporarily to flow into the river; but as soon as practicable it should be further purified by intermittent filtration through land, and then allowed to flow into the river. The Commission further advises that in all future drainage works the sewage "should be, as far as possible, separated from the rainfall." Notwithstanding the enormous amount of the London sewage, the Commission believes that land enough for purifying it can be had, at reasonable cost, within a convenient distance of the outfalls. The disposal of the sludge deposited from the sewage would be a rather serious matter, but the Commission can think of nothing better to do with it than to have it "applied to the raising of low-lying lands, or burnt, or dug into land, or carried away to sea." None of these seem to be very satisfactory solutions of the problem. Low-lying lands filled up with sewer-mud would, we should say, be anything but favorable to the health of those who lived on or near them; and all the other methods of disposal are costly, and bring no return whatever. It has often been proposed to make cement from sewage sludge, and good cement has actually been so produced, we believe, but the composition of the sludge must be too variable to make the process a certain one, and the Commission appears to ignore it altogether in its report. It seems not impossible that the sludge might be utilized for gas-making by some process yet to be invented, and this may prove to be, after all, the most profitable way of disposing of it. Much of the organic matter contained in it would yield hydrogen by distillation, and if some method were devised for decomposing, at the same time, the water contained in the moist precipitate, perhaps a form of water-gas might be evolved of some value for heating, if not for lighting, and the mineral residue, after the distillation of the gas, would be at least more desirable as filling material than before.

THE *Scientific American* quotes from the London *Times* an interesting account of a surgical experiment recently made with the happiest results at one of the English hospitals. A patient was recently admitted to the hospital, affected with a sort of paralysis which follows the formation of a tumor on the brain. Hitherto, such tumors have been looked upon as inevitably fatal, and nothing is usually attempted but the partial alleviation, by means of narcotics, of the patients' sufferings. Not long ago, however, it was discovered, through experiments upon animals that the different portions of the brain were connected with distinct groups of nerves running to other parts of the body, and that in case of lesions of the brain, the seat of the disease might often be ascertained by observing the manner in which the various nerves of motion and sensation were affected. By many trials with animals the connections of brain and nerves had been so clearly defined that operations on the brain had been successfully employed for affecting certain nerves corresponding to the portion of the head on which the operation was performed. No surgeon had, however, ventured to use this knowledge in treating a human subject; but Dr. Bennett, the physician in the present instance, having interested himself in trying to trace the locality of the brain tumors from the groups of nerves affected by it, became convinced that it was as yet of small size, and confined to a certain spot in the right side of the brain. Of course it was growing, and the fatal end of the disease could not be far off, but there remained a few days within which, judging from the results of the experiments upon the lower animals, it might be possible to reach and extirpate the tumor, the first in that situation which had ever been either cured or touched in a human subject. The case was then explained to the patient, and he was shown that on one side lay the certainty of a few months of increasing suffering, with death at the end; and on the other, a novel and dangerous operation, with a strong probability of fatal result, but affording on the other hand, a possibility of complete relief. The patient immediately chose to undergo the operation, and the skull was trepanned in the presence of a number of physicians at the exact spot which Dr. Bennett pointed out. Under the opening, as he predicted, was found the tumor, about the size of a walnut, and easily removed. The extirpation of the tumor was followed by immediate relief, and the patient was in a few days convalescent, with the prospect of many years of useful and happy life before him.

STROLLS ABOUT MEXICO. — IV.



THE most famous of the suburbs of Mexico is the villa Guadalupe, the scene of the most popular legend of the Catholic church in the New World. This was the apparition of the Virgin, on the hill of Tepayac, to a poor Indian, Juan Diego, in the year 1531, a little over ten years after the Conquest. The marvelous tale spread rapidly and received universal credence throughout Spanish America. Nuestra Señora de Guadalupe, Our Lady of Guadalupe, became the patron saint of Mexico. In her name the struggle for Mexican independence was conducted. The legend of Guadalupe has never, I believe, received the sanction of Rome, but neither has it been disapproved, for it may almost be called the corner-stone of the church in Mexico. Immense treasures have been lavished upon the spot, a remarkable group of shrines has been established, and every year, on December 12, the anniversary of the Virgin's appearance, vast multitudes from all parts of the republic throng thither to do homage to their saint. Guadalupe is one of the favorite given names in Mexico, and it is applied to males as well as to females.

The tramway cars run out to Guadalupe every half-hour, and it takes about half an hour to get there. The road is a straight, broad causeway running near and parallel with the railway from Vera Cruz, which enters the capital over the ancient causeway. When I first came to Mexico over that route, I was puzzled at the sight of large sculptured tablets standing beside the track, seen for an instant through the gloom of the evening as the train dashed past. It seems that they were the twelve "stations of the cross," erected for the devout pilgrims to Guadalupe, but rendered useless through the occupation of the old causeway by the railway tracks.

When within a few minutes of the villa, we pass the mineral spring and thermal baths of Guadalupe. People come out from the city as early as five o'clock in the morning to bathe here. The spring boils up in considerable volume in a basin amidst a pleasant garden. The water, which is aerated and strongly impregnated with iron, has an agreeable taste.

The great cathedral church has a large open space in front and on one side; it is chiefly of brick. Its proportions are noble; it has a dome and four towers at the corners. The great interior, with tall columns and beautiful arches, is impressive, but its venerable dignity is somewhat impaired by the spic-and-span newness of its decoration of glossy white and glittering gold.

A charming little garden adjoins the cathedral chapel and the tramway station. The heights of Tepayac, crowned with a chapel, rise picturesquely beyond. Crossing this garden, we come to a circular edifice capped with a dome of glazed tile laid in zigzag pattern. This is the chapel of the sacred well, to which miraculous qualities are ascribed. The water boils up, a turbid, rusty brown, so

uninviting in appearance that strangers, unless led by devotion, generally refuse to drink. The taste is, however, not unpleasant, and the color comes from the large quantity of iron held in suspension.

In this neighborhood the ground is covered with the wares of pottery-venders made in this neighborhood; the pottery is a dark-brown, glazed, and is distinguished by its graceful shapes. Among the various vessels are some curious ones made in the shape of ducks.

Across the way from the chapel of the sacred well, a long flight of irregular stone steps ascend to the chapel on the hill. These steps command beautiful prospects; they are guarded, here and there, by massive walls with inverted arches, which, with the neighboring domes and towers rising above the housetops of the town form effective bits of composition. A queer monument stands near the summit: the prow, mast and sails of a ship are reproduced as faithfully as possible in stone. It was built by a Spaniard many years ago, having, when in great danger from a storm at sea, vowed to the Virgin of Guadalupe that, if he should reach land in safety he would erect this monument in thankful commemoration.

The chapel at the summit is not particularly interesting architecturally, but is ennobled by its magnificent site, which commands a far-reaching view over the beautiful valley and the neighboring great city. The pulpits in the interior are of elaborately and gracefully carved wood. This chapel occupies the site of the shrine of Tenontzin, the goddess of the field and of corn, a mild Aztec deity who rejected human sacrifices, demanding doves, fruits and flowers. It was on this mountain that Juan Diego found growing the miraculous roses which, when he showed them to the archbishop, left the print of the image of the Virgin of Guadalupe on his apron. Possibly it was for the reason of this being the site of the shrine of the mild goddess that the shrewd Church fathers chose it as the place for the apparition of the gentle Virgin whom they desired to see supplant the former in the affections of the natives, tenacious of their ancient faith.

We descend the hill by a tortuous path on the other side. Upon the slope we come to a house where we pay six cents for the privilege of seeing the wonderful garden in the rear. We enter and stand amazed in the presence of a gorgeously glittering scene which appears like the transformation piece of a fairy spectacle at the theatre. It is on the rugged side of the hill, and the rocks are completely encrusted with a gay mosaic of broken colored crockery, such as might be obtained from innumerable mugs of the "For a Good Boy" style. These mosaics are arranged in decorative designs, and the whole covered with clambering vines and with a profusion of blooming plants all about, makes an effective though bizarre sight. The side of one building is covered with this mosaic-work, showing figures of a cow and a monkey beneath a tree.

Back of the town a massive aqueduct comes winding in from the mountains. It terminates in a richly sculptured fountain, dilapidated with age. The water pours down in clear cascades, forming a pleasant brook with grassy banks. Here, of a Sunday, crowds of Indians of both sexes may be seen washing their garments and bathing themselves, in naïve disregard of conventionalities.

Rambling in the fields about the town, we came across a charming

view of the cathedral in the distance, with its dome and towers filling in the vista between a poplar and a palm.

There are pleasant suburbs all about Mexico. The favorite spots for country homes are Tacubaya and San Angel. Tacubaya lies to the westward of the capital, a short distance beyond Chapultepec. It is a city of about eight thousand inhabitants. Lying on the slopes of the foothills, it is well drained and has pure air. Many houses here have beautiful grounds, which, however, are not visible from the streets, being either in the rear of the dwellings or enclosed by high walls, as in most European suburbs, affording only chance glimpses through the barred entrances. Suburban life in Mexico was in disfavor for many years, owing to the prevailing insecurity and the difficulty of communication; but with the construction of the tramway lines, and with the growing security of an era of peace and tranquility, it is growing in favor. Many cultivated people live in Tacubaya the year round, and many others have summer homes there. A new suburb is growing rapidly on the Castañeda hacienda at Mixcoac, between Tacubaya and San Angel. The lots there are sold on the instalment plan.

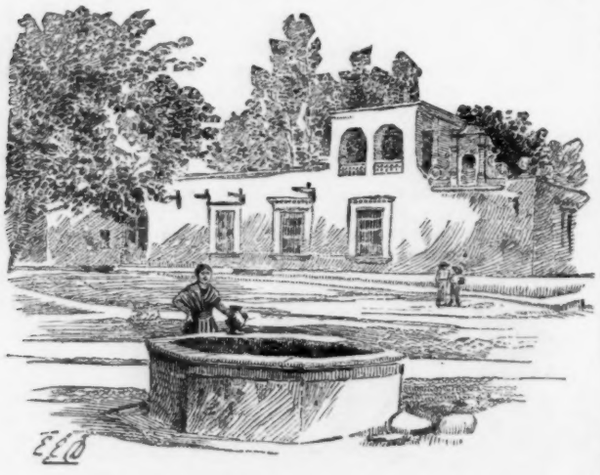
There is a handsome street leading up to the barracks in Tacubaya, between shady gardens where roses garland the high walls. A strip of delightful pleasure-ground, through which a clear brook swiftly runs, ornaments the street in front of the barracks, and here

the fine battalion band frequently plays. Farther up the street there is one of the grandest views of the two great snow-covered volcanoes to be had in the Valley of Mexico.

The picturesque forms which all work of man seems involuntarily to assume in this country was exemplified in a brick-kiln which I came across in a stroll about Tacubaya. It was set in the midst of a field of maguey, and its proportions could hardly have been finer

had they been intentionally designed for effect: particularly happy was the strong arched doorway, with rich, deep shadow.

San Angel is also in high favor as a summer residence, but it does not contain such valuable estates as some of those in Tacubaya.



The houses used for summer homes only are generally barely furnished, for a sort of camping-out life, but it is difficult to judge the interior of a house by its external aspect. San Angel lies near the mountains, in a charming situation. It is surrounded by market-gardens with a profusion of fruit and flowers. The hedges about the Indian huts in the neighborhood are generally a tangle of exquisite roses, and in the early morning the second-class cars going into the capital are embowered with flowers for the market. Strawberries are grown here in abundance, and are to be had nearly throughout the year.

Other pleasant suburbs are Thalpam, about twelve miles out to the southward, near the foot of the lofty mountain, Ajusco, and Atzcapotzalco, lying northwesterly from the city. An American friend never could master the difficult orthography of the latter place, which he always referred to as "that name on the street-cars."

Sylvester Baxter.

The Bastien-Lepage Exhibition and our Customs Laws. — Another illustration of the queer position which we occupy in matters of art is furnished by a lately published paragraph about the Bastien-Lepage exhibition to be held in Paris. It is well known that one of the most celebrated pictures by this lamented young painter, the Joan of Arc, is in this country, in the possession of Mr. Erwin Davis. Naturally it is the desire of the committee to obtain the loan of this masterpiece, and Mr. Davis is reported to have generously consented. Owing, however, to the state of our tariff laws, the picture, having once before paid 10 per cent duty on its first entry, will have to pay another 30 per cent on its return, which, together with packing and transportation charges, will make necessary an expenditure of about $4,000, all of which Mr. Davis is said to have declared himself willing to bear. That is a pretty heavy penalty to pay for the crime of enabling one's poorer countrymen to see an important work which otherwise they might never have seen, and being desirous of doing honor to the memory of a deceased artist. Put this and the former item together, and add as a sweetening the Pedestal Fund scandal, and who will dare to deny that we are a great people? —*New York Mail and Express.*

ELECTRIC-LIGHTING.

WHEN years ago the electric arc was known to most persons only in laboratory experiments, performed occasionally to illustrate of the power produced by a large number of galvanic cells; and the incandescent light, as now known in commercial use, was regarded as a visionary idea of learned experimenters. At the present time the arc light may be seen in almost any large town in the United States, while the incandescent light is already becoming a rival to gas in large factories and in some of our large cities. The factor which has produced this great change is the discovery of the dynamo-electric generator commonly known as the "dynamo." By means of this machine it has been found possible to produce large quantities of electricity, in what may be called commercial form, at a comparatively small cost. A dozen years ago the galvanic battery was, to most people at least, the only means of producing a useful current of electricity, while now the "dynamo" is looked upon by any one at all conversant with the subject as the best method of producing any large quantity of electricity. There are two essential parts to this machine: a number of electro-magnets for producing what is known as a magnetic field, and a number of coils of insulated wire attached to a spindle or axle, by means of which they can be revolved close to the electro-magnets, and consequently in the magnetic field. The result of the motion of these coils through this magnetic field is a current of electricity varying in quantity and pressure or tension according to the variation in the amount and size of the wire in the revolving coils and field magnets, the speed at which the axle turns, and the manner in which the coils are wound. The axle and coils attached to it are known as the armature, and to the end of the axle is attached a series of metallic strips for bringing together the currents produced in the coils; this is called the commutator, and from it the combined currents are led to the metallic conductors, which convey them to the point where they are to do their work. In electric-lighting, these conductors are usually made of pure copper, because this metal offers comparatively little resistance to the passage of the current, or, in electrical language, has a high conductivity. They are also carefully insulated, or separated from all foreign substances which might divert the current from its proper course, and in some cases cause serious danger from fire.

The lamps which are used in connection with the electric current for producing light are of two kinds, the "arc" and the "incandescent" lamp. The arc-lamp employs the electric arc which is formed between two carbon pencils withdrawn a slight distance from each other during the passage of a powerful electric current, and consists merely of mechanism for producing and maintaining the proper distance between the carbon pencils, which serve very much the same purpose as the wick in an oil-lamp, as they convey the electric current to the point of combustion. They differ from the wick in that they furnish the material for the combustion, while the main source of the combustion in a lamp is the oil which the wick brings to the flame. The particles of carbon which furnish the light in an arc-lamp are torn off by the current in its passage, and heated to the greatest known degree of artificial heat by the process of tearing off, thus producing the very brilliant light with which we are all familiar. The objections to the use of this light are three: first and chief, there is great trouble in keeping the light at all steady, either in color or illuminating power; second, the carbon pencils have to be renewed after burning seven or eight hours, although there are some lamps in which a second set of carbons is automatically brought into the circuit when the first set is consumed; and third, the very brilliancy of the light and the small size of the point from which the light radiates make the shadows of things near the light very large and very black. This is especially noticeable when one compares them with the large incandescent-lamps which are now coming into use, and which give a very steady and evenly-distributed light, and which seem likely to supersede the arc light for interior lighting, though the greater power of the arc-lamp will make it a better illuminant for outdoor work, and perhaps for some large buildings, where steadiness of light is not important.

The incandescent light is, when properly managed, the steadiest light which can be produced, and should burn from five hundred to a thousand hours before needing renewal. The light in them is not produced by combustion, but by the glowing of a very fine strip or filament of carbon, which is heated to a high degree by the passage of the current through it, but is not consumed, as it is in a vacuum in which there is, of course, no oxygen to complete the combustion. There are several kinds of incandescent-lamps, of which the best known are those invented by Mr. Maxim, Mr. Edison and Mr. Swan, but they differ only in the manner in which the carbon filament is prepared, as they and all other incandescent-lamps now in use

consist of a glass globe in which the filament is placed, and from which the air is exhausted as completely as possible. To the ends of the filament are attached platinum wires, which pass out through the glass and serve to attach the lamp to the electric circuit. These lamps give off very little heat, and can be handled at any time while heated. The position of the lamp, moreover, does not at all affect its brilliancy, and it is thus possible to use it in forms and in places where a lamp giving much heat or depending on an upright position could not be used. The Edison Company in particular, have made festoons of these lamps placed in and among colored globes, so as to look like great masses of glass flowers brilliantly illuminated from within. Another advantage of the incandescent light is that it consumes no oxygen and does not give off carbonic acid gas, which renders the air so injurious in large halls or offices lighted by gas. In Boston, for instance, several banking-houses have used this light for some time, and find it makes a visible difference in the character of the air in their offices, which before became disagreeable a short time after work began in the morning.

These lights are now made of several sizes varying from the power of ten standard candles to that of three or four hundred standard candles. To compare them with gas we may say that a sixteen candle-power lamp is about equivalent to a six-foot gas-burner with a flat flame on Boston gas. These can be produced within one thousand feet of the source of power with an expenditure of a fraction more than one-tenth of a horse-power apiece, and the amount of power required is only slightly increased when the lights are placed within a mile or two of the source of power. It is, however, necessary to increase the size of the conducting wires in proportion to the distance, so that lights used at a long interval from the dynamo-machine require a larger expenditure of money per foot for conducting wire than those nearer. Thus the conducting mains of the Edison Illuminating Company in New York City are of solid copper, and about an inch in diameter; it is necessary to lay two of these to complete the circuit, and it is easy to see that there must be a very large amount of copper in each mile of circuit. In spite of this large expense it seems likely that in our large cities these lights can be furnished in large quantities at very nearly the same price we are now paying for gas, and this is quite as true of other lights, as it is of those manufactured under Mr. Edison's patents. In many of the large manufacturing establishments incandescent lights have been introduced with the most favorable results, as from the absence of heat and smoke they can be placed where it would be impossible to put a gas-flame, and thus can be brought to throw the light more exactly where it is needed. Here again the increased purity of air is a great gain, as any one who has been often in mills will know; and where the lights are produced by the same power that drives the mill they can be very cheaply furnished.

There is a general feeling that there is necessarily a great risk both to human life and to property from the use of the electric light; but this feeling is not at all justified by facts. It is undoubtedly the case that if not carefully handled, or if conducted by improper apparatus, electricity can do much damage; but I believe less loss has been caused by electricity during the past year than by either gas or kerosene, taking each in the proportion of the amount of light furnished; and this too, in spite of the fact that electricity is an element of which we know but little, and which has come into use faster than any other illuminant. The arrangement of wires and other apparatus for securing freedom from danger in the use of electricity is a subject which has received much attention, and every electric-lighting company has rules, which, if rigidly adhered to, would make the danger from their lighting currents very slight.

In considering the problem of introducing electric-light into buildings the first question will usually be how to obtain the necessary current. In most of our large cities there are companies who make it a business to furnish electric current either for lighting or power, but in mills or in buildings so situated that the necessary current cannot be obtained from an outside source it may be necessary to obtain a dynamo and power to produce the necessary current. The essential thing in power for electric-lighting is absolute steadiness of speed, especially for incandescent lighting, and this is best obtained from a water-wheel if one can be had, and next to this the power produced by a high-speed engine, as in these the decrease in speed at each end of the stroke is less than in an engine making a long slow stroke. When the current is furnished by a local company, it is usual to have them do all work of putting in wires and fixtures, and I would advise all persons intending to have wires put into any building to employ the services of an electric company for this work, and not to entrust it to men who are only accustomed to wiring for electric call-bells, gas-lights, and the like. The work of putting in wires for electric-lights is a very different matter from any other kind of wiring, and requires a knowledge of electrical resistance, and of the heating power of lighting currents which most of the bell-hangers by no means possess. In one house which I was asked to inspect quite recently, part of the work was done by men quite competent to do the wiring for electric-bells and gas-lights, but in wiring for incandescent lights they had used nearly twice as large a wire in some places as was necessary, and in others had gone to the other extreme and used wire much too small. They had also placed the wire in such a way that a fire would have been almost inevitable had the wires ever been used for electric-lighting. Another caution seems appropriate in this place: in placing wires out of sight, it is much better to put them in grooves in a board coming flush with the surface of the finished wall, and to cover the grooves with a strip of moulding fastened on with screws, so that it can be easily taken off at any time to get at the wires. The reasons for this way of putting in the wire are, first: it is always desirable to be able to see any part of the wire some time after the building is completed, and if it is put behind the plastering this becomes impossible without cutting it in many places; in the second place wire run in grooves in this way is much more likely to keep its insulating covering perfect than if it is exposed to the moisture which often collects on brick or stone walls, and which is always present in fresh mortar. I cannot express too strongly the feeling I have against concealed wires for electric-lighting, in connection with the risk of fire. When wires are in plain sight any trouble on them will probably be noticed before it causes fire, particularly if inside buildings, but with concealed wires it is very difficult to discover any disarrangement before the wire gets to a dangerous state. All wire for electric-lighting should be protected by a covering not easily removed and not inflammable. Parafine should be particularly avoided in the insulating covering, as rats are very fond of this substance, and are likely to gnaw the covering off the wire to obtain the parafine.

In all wiring for incandescent lights it is usual to introduce pieces of metal of low fusing point which will be melted off by any injurious excess of current, thus destroying the circuit, and stopping the flow of the current before the conducting wire is unduly heated. These pieces of metal are called "safety strips," and are put in where the conductors leave the dynamo, and wherever the wire branches. All circuits whether for arc or incandescent lighting should be kept carefully away from water-pipes, gas-pipes, and other metallic bodies likely to make a connection across the wires or from one of them to the earth, and should so be placed that there shall be no danger to the insulating covering from tables, chairs, or other movable objects. If the precautions noted here are observed, and the wires and dynamos installed by persons familiar with this kind of work, and the whole handled in accordance with directions obtained from them, I believe electricity to be the safest method of illumination yet discovered.

F. ELLIOTT CABOT.

ON THE LOIRE.

HOTEL-de-VILLE: DANS LE BRUGES: BELGIUM:

IN the afternoon of a faultless summer day we are steaming rapidly over the smooth waters of the lower Loire. For the last hour or two we have been stopping at or passing picturesque French villages, the houses clustering down almost to the water's edge, or sheltered behind rows of trees; the inevitable café lies close to the wharf, its little outside chairs and tables deserted, as the steamer stops at the pier, and their occupants join the throng of peasants, men, women and children, who evidently regard its coming as the event of their quiet day. Church spires and towers dominate the scene at intervals as we glide along, and more than one large *fabrique* testifies that a lot of work is done on the river. Steamers and barges come and go, the banks on each side become more thickly populated, the buildings increase in number and in size, till, as the afternoon wanes, we run between a lofty cliff covered with houses on one side and an island with busy ship-yards on the other, and we are at Nantes, the Manchester of France. No approach to a city could be happier. As the houses rise terrace upon terrace, with the dome of a church here, the towers of the cathedral there, and handsome public and private buildings along the quays, the impression is a very favorable one. We have some distance to go, also, ere the steamer comes slowly to her berth, and ever as we advance, the views become more interesting. It is a handsome town as seen under the light of the warm afternoon sun, and there is a freshness about the character of the streets which promises well for a closer inspection. At present, however, we are most interested in getting a comfortable lodging, and, as the steamer comes to a standstill, and our traps are seized by the ever-ready porter, we come to a little understanding with him and tramp off in his wake to a hotel. Along the quays we trudge, over a bridge, past the pillared Bourse and the brand-new post-office, till our guide, stopping at a little hotel overlooking the Canal St. Felix, we are ushered upstairs, and from the windows of our room what a prospect! Before us is the glory of Nantes, its château, a high group of buildings surrounded by a moat and protected by great circular bastion towers and hoary walls. Fortress, palace, prison, barrack, it has been all in its time, and the whole history of the town seems written on its face. How we thank our friend, the porter, for such a lucky choice! how we long for the morrow, when we can get inside! We feel almost impatient of the time taken up by dinner, that we may sally forth to inspect its formidable-looking exterior. The trim French waiting-maid does not

hurry, however, and, ere this can be done, the day is fading into a glorious, golden purple twilight, slowly but surely changing every minute, under the increasing silvery radiance of the full moon. The view of this grand old château on the quay, the gray cathedral towering over it on the high bank above, the long rows of trees in the Place St. Pierre, with the upper town beyond, all bathed in this golden evening light, make up a picture never to be forgotten. As we sit between the lights, and watch the changing tints in the cloudless sky, each pinnacle and turret of the old cathedral stands out sharp and clear in the wonderful atmosphere. Anon the moonlight obtains the mastery, we quit the fairy-like scene and wend our way into the lamp-lit streets.

When we come to inspect the château next morning, we find it a cluster of buildings surrounding a court-yard of irregular shape, approached by a draw-bridge over the moat. It was founded about the tenth century, but has been mostly rebuilt by Duke Francis the Second, about 1466, though some of the towers are older. The principal block of buildings on the right of the court-yard is now used as a barrack; it dates from the sixteenth century, but has been recently restored under M. Mênard. It is chiefly remarkable for the staircase-tower at one end and the splendid series of dormer-windows along the flank. They remind one of the better-known examples at the Palais de Justice at Rouen, being similar in style and with equal richness of detail. Nearly opposite this barrack is the armory, and between them, but at right-angles, is the chapel. This chapel is late fifteenth-century work, but has been so much restored that a good deal of the old character has vanished. Here the Duchess Anne of Bretagne was married to the French king, the château being a favorite residence of the Dukes of Bretagne. In the court-yard is a famous well, covered with a splendid canopy of wrought iron-work, which fortunately the hand of the restorer has not yet touched. Historical incidents of many kinds crowd each other in such a place as this: we can only mention such names as De Retz, Froquet, the Duchesse de Berri, Henry IV, Mme. de Sevigné, in addition to the great duke and duchess before mentioned, as a few of those whose presence haunts the spot.

Next in interest to the château is the cathedral church of St. Peter. It is very good fifteenth-century work, with two west towers and three very fine doorways in the west front. The detail throughout is stronger and better, and the whole style less flamboyant than one usually finds in French work of this date. The fifteenth-century builders seem to have stopped short at the crossing, as the choir, with its fine apsidal chapels, is only now being finished. It has been carried out in the same style and with the same detail as the nave: the architect has cleverly caught the spirit of the old work in the most satisfactory manner. We regret his name has slipped from our memory, as this choir is certainly the purest and best modern French Gothic work it has been our lot to see. In spite of the teaching and the brilliant example of the great Viollet-le-Duc, the French architects have never taken kindly to the Gothic revival; but here the old work seems to have been faithfully studied, and with the happiest result. When finished, the church will be one hundred and two metres long; the old nave is twenty-five metres broad by about thirty-seven metres to the crown of the vault, and the towers are sixty-three metres high. The remains of the old twelfth-century choir have been laid bare during the operations; and a most interesting apsidal crypt, with its pillars and arches, is now opened up below the floor-line of the new choir. There must also have been a tower over the crossing at one time, as the piers are of great strength. It is curious, also, to observe at this point the work of several generations of builders. We have twelfth-century shafts and capitals and indications of arches; restorations and additions to them in the fourteenth and fifteenth centuries, and again with Classic mouldings and details of the seventeenth century; and lastly, a low-domed plaster ceiling of about the same date, and painted with figure-subjects. This, we presume, will be all cleared away when the new choir is thrown into the church: regretable, perhaps, but necessary.

The most remarkable monument is that of Francis II and his second wife, Marguerite de Foix, in the fourth transept. It is an altar-tomb, built in 1507 by Michael Colomb; has recumbent figures of the Duke and Duchess on the top of the slab, with allegorical figures at the angles, and small statuettes in a kind of arcade round the sides and ends. Though late in style, the detail, Renaissance in character, is good, and the whole work is exceedingly well carried out. In the north transept is the classic monument of General Lamoricière, built in 1879, from the designs of M. Boitte, architect, the sculptured figure by M. Paul Dubois, sculptor. Under a marble slab, which is supported by pillars of colored marbles, lies the figure of the General, while at the four angles are statues in bronze, representing the four great virtues. It is an admirable work, and while following the lines of the old altar-tombs, is thoroughly Classic in feeling, and very carefully detailed.

The most important church, after the cathedral, is that of St. Nicholas. It is a new church, from the designs of M. Lassus, Early French Gothic in style. It consists of nave and aisles, transepts and apsidal choir, with five chapels. It has a high clerestory and triforium all round, and is vaulted throughout. It has a western tower and spire eighty-three metres high — one of the landmarks of Nantes — and a small *flèche* at the crossing. It is a large, ambitious church, fairly well carried out, correct enough as to style, but hard and lifeless as most modern French Gothic usually is. Its details lack the careful study which is so noticeable in the new choir of the cathedral, and, though the church is impressive from its size and great height, when one begins to look closer into the work, it is not nearly so satisfactory. The painted glass in the choir, also, is poor stuff, compared with the best of modern English work of the same style. This church is only another proof that French architects of to-day are much more at home in Classic than they ever will be in Gothic. A walk down the street to the church of Notre Dame de Bon-Port still further confirms this impression. It is a Classic church, with a fairly good dome, and was built about 1846, from the designs of M. Chenantais. The dome is another of the landmarks, and forms a striking feature as seen from the river. In plan the church is a Greek cross, the dome being carried on four great arches. The eastern arm is the choir, the north and south arms the transepts, and the western arm, slightly prolonged, is the nave. Internally the church is architecturally simple to a degree, but it is enriched with much painted decoration in the way of figures and ornament of a very second-rate character, which goes far to destroy the otherwise good proportions of the interior. In spite of this, one feels the architect is at home in the style in which he is working, and the result is therefore more satisfactory than the would-be thirteenth-century stuff at St. Nicholas.

Among the public buildings the Grand Theatre is one of the most noteworthy; it was built by Mathurin Crucy in 1788. It has a fine octostyle portico of Corinthian columns, supporting an entablature and an attic; on the latter are placed *eight* statues of the Muses, the *ninth* we are told "found a refuge in the Bourse!" The interior of the theatre was destroyed by fire in 1796, but was rebuilt in 1811, restored in 1844, and again in 1863. It is considered the chef-d'œuvre of its architect, and one of the best theatres in France. If we mistake not the same architect built the great theatre at Bordeaux, which is certainly one of the finest in the country.

The Bourse just mentioned is also a fine structure. It is situated on the Quai de la Fosse, was built in 1792 to 1812, and contains the Tribunal and Chamber of Commerce. The west front has a fine portico of ten Ionic columns, surmounted by statues after the manner of the theatre façade, and in the same phase of French Classic their architects know so well how to use. Indeed the artistic treatment of this Classic work is one of the attractions of Nantes to an architect; it meets one everywhere, along the quays, in the streets and squares, in public and private buildings of all sorts and sizes; it is thoroughly at home, and notwithstanding the variety of its treatment it is never out of place. It seems indigenous, and what is more it gives the town an individuality of its own; it never apes Paris, as the newer parts of Brussels and Rouen do; it is always provincial, and so always interesting, giving Nantes the appearance of a well-built, well-to-do, handsome town. The traditions has also been well maintained. The new Rue de Strasbourg is a handsome street, and the new Palais de Justice built about 1850 is a monumental work with a rich colonnade and a fine staircase; it is also adorned with statues by M. Mênard. The new post-office on the quay, but recently completed, is thoroughly well-designed and has a business-like air quite in keeping with its purpose. The streets, especially in the older parts, say for instance from the cathedral to the theatre, are narrower than one expects to find in a town of its size, and the absence of any considerable wheeled traffic strikes a stranger. In the evening a carriage coming along the street is quite an event, and most of the people walk up and down the middle of the roadway. An arcade with three galleries, called Le passage Pommeraye, and built about 1843, is considered one of the sights of the town, but it is a poor affair after the great arcade at Brussels. A much greater attraction is the Museum of Painting and Sculpture containing something like one thousand pictures and one hundred and fifty statues, busts, bas-reliefs, etc. The pictures include examples of all the great schools: Italian, Dutch, Flemish, German, Spanish and French, and among the busts is that of Crucy the architect of the Grand Theatre. Besides the foregoing, there is the Archæological Museum, a collection of considerable interest, and there is a splendid public library, containing nearly one hundred thousand volumes, besides manuscripts, prints, pamphlets, etc., so that there is plenty to interest the visitor to Nantes.

It was the fine old château and cathedral, however, that proved the principal charm to the architect. The magnificent view of which they formed the principal features was the first thing our eyes rested on in the morning, the last thing at night, as we sat smoking in the little balcony of our room before turning in. Whether under the noontide sun, or bathed in the splendid moonlight, those grand old buildings were always impressive, always fascinating, speaking to us in tones far more eloquent than words. They were among the last objects on which our eyes rested as we ran slowly past them by rail, when we left the city on the way to St. Nazaire, as they will be ever the centre of the picture left in one's memory.

The country between Nantes and St. Nazaire is not particularly interesting. The undulating character of the scenery falls away as we near the mouth of the river. At Savenay Junction there is an interchange of traffic. Here are to be met "all sorts and conditions" of Bretons of the type we are fast becoming familiar with, particularly the peasants, a comely reliable race, who without any great claim to personal beauty, look strong and healthy and are always more or less interesting. Almost across the river from Savenay is Paimboeuf, a picturesque village close to the water side. So is Basse-Indre, a little higher up on the right bank. As we approach St. Nazaire the air is clouded with the smoke of tall chimneys, and resounds

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ARTIFICIAL STONE. — PROCESS OF THE STONEY LANDING COMPANY.

The process of the Stoney Landing Company for making stone from sand and lime is an economical one and has been worked out on a commercial scale. It is not a laboratory experiment, but the stone *is* made at a cheap price, *has* been put into buildings and *has* stood all the weather tests successfully. It is made in the form of a large brick 9″x 4⅜″x 2½″, but it can be made of many shapes and sizes and can be moulded into ornamental blocks.

The Company has secured patents covering the process and the machinery essential thereto. Rights to manufacture under these patents it is proposed to sell, giving purchasers full plans for erecting works and machinery and the services of an expert to instruct in the process. The stone can, under conditions generally prevailing, be made cheaper than clay bricks and being more even, much handsomer, stronger and frost-proof, must compete successfully therewith and pay handsomely. In many localities where sand is plentiful, lime not too costly and clay scarce, a much larger profit can be realized. Owners of sand banks can convert them into money and lime burners find a more lucrative market for their product by means of this process.

Stone has been made by others from sand with lime as well as with the cements — good stone. The Stoney Landing Company only claims that its process makes better stone than has heretofore been made from sand and lime, and, by this process and the machinery devised therefor, it can be made at so low a cost as to ensure financial success in its manufacture.

For the details and *rationale* of the process we refer to the pamphlet published by the Company, "*Artificial Stone.*" In brief, the process is as follows: The lime is ground to a fine powder together with a given percentage of silica sand, fine giving better moulding results than coarse; is mixed dry with the ground lime and silica in a mixer; water and steam are then admitted and the mixing continues under steam heat until completed, when the material is dumped on a platform in rear of the moulding machine. This machine compresses the material by the blows of its steam hammer; then the finished brick is placed on suitable racks to dry until hard enough to stack. In the yard, when slaked, it is periodically watered.

The grinding of the lime and silica *together* insures an intimate mixture. The pulverization of the silica increases its surface, so when slaking takes place it is in a condition and position to be acted on efficiently to form the silicate of lime. The small quantity of water used and the steam heat seem to facilitate this formation. The great force used in the moulding-machine, drives the grains of sand into the closest proximity, requiring a *minumum* of cementing material and thereby increasing the strength of the stone. The after treatment by watering *is essential* to expedite the induration as it is a crystallization requiring moisture. The fact that this watering does harden, shows that silicate of lime has been formed and the cementing lime converted by the process into an hydraulic cement.

The stone is not injured at any stage by frost and the process can be worked in freezing weather. The stone resists the effects of frost and places it, for northern latitudes especially, among the best of building materials.

The works of the Company are located near Charleston, S. C., and the process will be cheerfully shown to any one visiting that city. Samples will be sent on application.

C. I. WALKER, Pres't
Stoney Landing Company.

PHŒNIX-CONSTRUCTION IN BUILDINGS, SHIPS, ETC.

A TRUE AND ECONOMICAL IMPROVEMENT. PATENTED, MAY 22, 1883, BY C. LEO STAUB, ARCHITECT.

In reference to my patent published in this issue of the *American Architect and Building News*, I wish to call the attention of all parties interested to the following description, in order to give some practical hints about its application, and to overcome the general opposition with which new improvements always meet.

Being an architect of twenty years experience, and having studied and witnessed the effects of the Chicago conflagration a short time after its occurrence, I have ever since sought to discover a species of construction, that should not be so expensive as not to be within the reach of almost every landlord, and at the same time one which could also be extended or applied to old buildings and ships; and I have succeeded at last with my "Phœnix-Construction," as follows: Since the great fires of that western metropolis and of Boston, and through the experience of very many minor conflagrations, the so-called fire-proof constructions have partly fallen into discredit, for not offering absolute safety, and for being decidedly too expensive for the majority of people. The preconception that building materials, which really are incombustible, offer sufficient resistance or protection for life and property against fire, has long ago disappeared among persons who have witnessed the effect of heavy conflagrations. Besides the exorbitant cost of these fire-proof concerns, they never had any claim to being waterproof, a quality indeed necessary to fill the bill of expectations or safe-guards, that are justly demanded by the public in a fire-proof building; on the contrary they are quite capable of soaking and holding considerable quantities of water, a constant source of moisture and therefore of disease to the occupants, and the cause of an early decay of the wood-work in them.

The main fault of the early, or the recently introduced methods of fire-proof construction in buildings is, that they consist of materials liable to a more or less great expansion when exposed to a fierce heat, and so those fire-proof floors, built of iron beams and girders vaulted in between with brick, hollow tiles, concrete and other non-combustible matter, cause a heavy strain on the walls and an ultimate collapse of said floors, while the melting of only one unprotected cast-iron column, or its sudden break caused by a spout of water thrown onto it when red-hot by the fire-department, is liable to tumble in ruins an entire fire-proof building at once.

Unprotected granite piers or columns in the interior of buildings or even in their fronts, and such built of certain marbles or limestones (all lime-containing stones without exception), are equally unsafe and dangerous; and where the fire does not cause so much damage, the expansion of said materials, in particular the bend and shrinkage of iron beams and girders, opens numerous holes and joints to give the water a fair chance to destroy in most cases more goods and property than the fire did.

Of late prominent authorities in building matters or in architecture in general have come to the conclusion, that the best we can do against conflagrations is to limit or confine any fire as long as possible to its starting place, to shut off all the air-draught between ceiling and floor (in floor constructions), and in particular to check the draught in the upright hollow partitions or in the hollow division-walls. The result of this true conclusion was the "slow-burning" or "mill-construction," by which heavy timbers are used for the open ceiling joists and beams, as well as for columns, and a double or three-fold floor, made of planks three inches thick laid over the joists, then a layer of three-fourths inche mortar or concrete, and finally the usual flooring boards; this is indeed a slow-burning construction and a very good improvement, but the mortar between the two layers of flooring-wood gets naturally soon converted into dust and powder on dry places, simply by the action of walking, working or moving heavy goods over the floor or by the tremulous action of machinery, while in buildings or mills where the floors are often cleaned or scrubbed with water, the same mortar is liable to decay, and rot the floor in a short time through its contained moisture; and so the intended checking of the dangerous air-draught between the joints of the timbers is secured only for a short time, and these and similar slow-burning floors, solid plank partitions, roofs, etc., become hereafter so much more dangerous on account of the immense quantity of lumber built in.

Now in the "Phœnix-Construction," I use all the different sheet-metals to shut off that dangerous air-draught, and fire and water alike in the most efficient manner by enclosing them entirely in wood, that very oldest and healthiest of building materials, the healthiest because it always exhales a quantity of oxygen, and in turn draws from the surrounding air some nitrogen, which purifying process never ceases, and this health-giving quality of rooms lined entirely with wood-work in the plainest as well as in the most exquisite joinery style, has far and wide been recognized all over the country, not to speak of other well-known preferences for wood constructions. I wish to say right here, that these thousand and thousands of rooms, halls, churches, residences, office-buildings, steamboats, railroad-cars, etc., built recently or yet in course of construction, all entirely lined with

wood decoration, give the very best idea, or make the most telling impression of, how the "Phœnix-Construction" will look when completed.

In this construction the building material, wood, need not to be applied in useless thicknessess, for the sheet-metal between adds a great deal to its natural strength, and is used not so much for its slow-burning capacity where the draught is excluded, but because wood is the best non-conductor of temperature, heat and cold alike, and because wood is about the only building material that does not expand itself when exposed to a high degree of heat, and even while burning; hence it will protect and keep in stationary shape the inclosed sheet-metal for the longest possible time, and prevent its bending, loosening, warping and melting, so that in an ordinary fire the damage done will be only to a few boards; while a casing of two or more layers of wood with intermediate sheets of metal, will protect all necessary iron constructions, such as rolled iron-beams, riveted girders, templates, trusses, cast-iron columns, piers, etc., for a double and four fold amount of time, from dangerous expansion or destruction even in a heavy fire, and so this "Phœnix-Construction" leaves the backbone of fire-proof buildings, that is, the walls and the inner floor-supporters, the iron columns and girders or beams, unhurt for a length of time that cannot be expected from any other fire-proofing method, because their expanding and easily cracking building-materials are attacked directly by the very quickly outspreading heat. But all these recently introduced fire-proof constructions, as well as all the old fire-proof buildings can be doubled in their safety, by a judicious application of this new safety construction, in particular in such cases where the iron-work has been left unprotected; also unprotected granite piers, etc., in the basement or elsewhere need the same incasing.

The public in general seems not to be aware of the facts, that these very hardest and strongest building materials, iron and granite, are very dangerous in a great fire.

Sheet-metal, as sheet-iron, steel, copper, tin, zinc, lead, brass, etc., painted, galvanized, varnished or not, has always been used or kept for a good protector, against fire, water, air-draught, moisture, rats, vermin, insects and theft; but heretofore it has been applied only outside as a cover or roofing, and so it was exposed directly to the decomposing influences of elementary powers and human or animal attacks, so that its durability and splendid protective capacities were never used before to any noticeable extent, while this new application of sheet metal makes almost an everlasting building material out of it, and brings it up to the high standard as the most economical protector of life and property.

Steel, copper, sheet-iron, galvanized and charcoal iron and tin plates will always prevent the passage of fire and water, when inclosed in wood as per patent specifications, and will allow a sufficient amount of time to the fire-department, or to any private fire-extinguishing apparatus to prevent any considerable damage, while the smoke and smell of the slow-burning boards will indicate the danger at an early stage. In the same way sheet-lead will produce the most perfect, smooth and noiseless waterproof-floor.

The secret of the incredibly rapid spread of fires in the majority of our old and new buildings and residences, lies in the long air-spaces along the joists between floor and ceiling, and in particular in the hollow stud-partitions, or outside walls in frame constructions (frame houses, the inside of brick buildings, ships, steam and ferry boats, etc.), because these air-spaces form a continuous row of horizontal and upright flues, and so they give the fire the best possible headway and cause the quickest destruction. It must be well understood that occasional wall-plates, horizontal and cross bracing do not check that air-draught at all, for these timbers and boards or plaster laths leave joints and holes wide enough for the passage of the flames; on the contrary they help the fire greatly as kindling wood, and so these hundred thousands of buildings, ships, etc., can be considered as no better things than man-traps or tinder-boxes, ready to destroy life and property at the slightest chance.

In order to overcome or cure this everlasting danger in old and new buildings alike, and to put them in a state of safety, that might well be compared with their present state of security, as to be in the proportion of one hundred to one, I have invented perfectly air-tight "separators," to divide all those dangerous air-spaces and flues into compartments to check the draughts and the spreading of any fire, to such a considerable extent of time by repeating them, that all those buildings and ships mentioned will certainly be made safe, if they are not left uninhabited or abandoned, and situated out of the reach of any fire-department or any private help.

I will remember here to speak about the exquisite practicableness of my "Phœnix-Construction" to transportable buildings for summer resorts, seaside and mountain alike, for military barracks in the far West and everywhere for out-of-the-way places; their resistible strength against cyclones or heavy storms makes them far safer than ordinary brick and frame-houses, and in case of fire a few buckets or pails of water will do.

These air-tight separators consist also of two or more layers of well-seasoned wood with intermediate galvanized-iron or other sheet-metal plates between, and put in position as shown in drawings and specifications. Such separators are also to be inserted in the incasing of iron-beams and girders, which support the floors in store-rooms, wholesale and retail warehouses, etc. These separators can be put in at a cost from twelve cents to twenty-five cents apiece, according to size and materials selected. Between the joists these separators are to take the place of the present cross-bridging, and they will add more strength to the floor, while for the stud-partitions or upright hollow walls, they are to be inserted at least three times, near the floor, near the ceiling, and once between, while in the first and second positions they will be covered in air-tight by a double base or cornice, and between floor and ceiling they will be inserted best at the height of the usual chair rail, or at the height suitable for hooks and shelves.

For securing old buildings after this Phœnix-Construction method, it is only necessary to take off a few boards in the floors, and about twelve inches of plastering, horizontally around the rooms, to put in the separators in their respective places, so that it will not be necessary to evacuate the houses while this improvement or fire-proofing is being carried out.

The underside of wooden stairways, the elevator and dumb-waiter shafts, if not built of brick should be protected first, and those numerous hotels, done or built in the old-fashioned careless construction, could well do away with those disgusting and disfiguring fire-escapes, if only their stair-ways, halls and elevator-shafts with their inclosing partitions were remodelled in the prescribed manner.

To put in my fire and water proof floors into old buildings, the sheet-metal selected can be spread over the present floor directly, and then a new flooring nailed or screwed down to the old one; screws are to be preferred, to make an air-tight job.

All these improvements, partly or as a whole, which the "Phœnix-Construction" contains, can be carried out by any ordinarily skilful carpenter in company with tin-roofers and metal-workers, and they require less time and cause less trouble than the fire-proofing with any other known solid construction, while their expenses underbid anything expected in comparison with the protection which they really offer.

Another source of danger in almost any present building, is the usual carelessness with which the plumbing and gas-fitting is cased in or left open entirely; my construction applies the same encasing as proposed for iron-beams, with occasional little doors at the connection points of these pipes. This encasing is in particular practicable for all sorts of electric wires, because wood is a non-conductor.

The safety of the contents of whole stone and brick built warehouses, in the neighborhood of an out-broken conflagration is too often dependent exclusively on the resistibility of shutters and night-doors on their outside, and from the resisting capacity of fire-wall, doors and hatchway-doors in their inside for one not to call special attention to this very dangerous state of affairs; the present iron-shutters, even when made out of boiler-plates and those wooden shutters, fire-wall and hatchway or elevator-doors lined outside with sheet-iron, offer not at all the safety expected, for this simple reason: Metal being the most speedy conductor of heat, it first attracts the heat or fire, then it expands, warps and very often flies away like paper. Whole books could be filled with tests, verifying this fact.

Heavy wooden doors can resist a fire for a longer time, than said old-fashioned or even new shutters, but the expected safety capacity of the sheet-metals will be preserved to its utmost extent, when entirely enclosed in the slow-burning building material, wood.

So I construct these shutters and doors in three thicknesses with two inlaid metal plates, as per patent drawing, and they will not cost half as much as the solid-iron shutters; while two thicknesses will suffice for outside or inside window-shutters or night-doors, it will be preferable to add more thicknesses to fire-wall and hatchway-doors, on account of the great responsibility that rests upon them.

This multiplication of wooden layers with intermediate sheet-metal plates leads to the construction of safe-vaults and safes, as specified in the patent in such a manner that in a heavy fire the outer half of the new construction can be destroyed without injuring its inner half part and its contents of valuables.

These safe-vaults have the advantage over safe-vaults built in brick, stone or heavy metal construction, that they can be built in or moved into any frame-house, or brick and stone building of light construction, because their little weight requires no extra foundation-walls or iron-girders for support; and, comparatively cheap as they will be, they are specially adapted to form family-safes for the silver-ware, documents, etc. There should be at least one in every residence, old or new.

Burglars will greatly be baffled, while trying to cut holes through these Phœnix concerns.

The formidable strength of this new construction can best be appreciated, when account is had of the facts, that sheet-metal embraces all sizes, from the thickness of paper up to that of the strongest boiler-plates, and that the thicknesses and kinds of the wood-work are simply unlimited, so it will easily be understood to what safety, durability and solidity the "Phœnix-Construction" will lead.

These specified walls for safety-vaults are also adapted to form the main shell or body for ocean steamers and parts for war ships: experiments will probably establish a far better result with such a construction than with solid cast-steel armor, and while a projectile of our heaviest guns will cause a hole, from five to ten feet in width or more in a solid steel-clad vessel, it will only cut a hole of the size of the projectiles diameter through my construction, which can quickly be filled up by a bung or cork-like body kept ready for the occasion.

The proposed air-chambers in modern men-of-war, to render more bearing capacity, would be far better when filled in with very light wood, which prevents the entrance of water under all circumstances, and with this prevents its otherwise possible sinking.

Another quality of preference for the adoption of the "Phœnix-Construction" for ship-building is to be discovered in a certain elasticity or elastic resistibility, which will greatly lessen the power of explosions from powder, steam or dynamite, and make these ships less dangerous for themselves in encounters and against shocks,—a very estimable quality, which the old wooden war vessels partly possessed. The far lesser weight of such ships will allow them to carry more cargo, and for a man-of-war more or heavier guns, while their speed will be increased, and their turning movements rendered more easy.

The "Phœnix-Construction" embraces: —

I. Four different kinds of fire-proof and water-proof floors and ceilings.

II. Fire-checking air-tight separators between the studs in our hollow wood partitions or in the outside walls of frame buildings and ships, as well as between the joists in order to do away with the usual kindling-wood of the cross-bridging, and also to do away with those European blind floors, or that sheathing filled-in with rubbish, straw-mortar or concrete, a constant source of moisture and disease for the inhabitants, and the direct cause of an early decay of the joists, beams, flooring-boards, and all the wood-work about it.

III. Fire and water proof outside and inside shutters, night-doors, fire-wall doors, elevator, dumb-waiter and hatchway doors.

IV. Three different kinds of hollow and solid partitions, the hollow partitions are to take the place of the present plastered partitions, for at least a part of their height, the wainscot or panelled wood-casing, while the outside walls of all frame buildings, ships, grain-elevators, dock and ferry stations, ice-houses and refrigerators can be formed by it to any suitable strength or required thickness; a very light hollow partition or an inside lining of it for large halls, music-halls, court-rooms, churches, etc., will give to such public places the best possible *acoustic qualities* for old and new buildings alike; the solid partitions, panelled or not, will take the place for the present tinder-box construction in steamboats and ships, necessary for the inside arrangement of the cabins and other rooms, as well as in warehouses and office-buildings those thin divisions on the lower part of sash partitions, parts of the office furniture, and for the general construction of freight-cars and other railroad cars.

V. The encasing and protection of cast-iron columns, piers, riveted iron posts and columns, granite and limestone piers, and for wooden columns and posts.

VI. The encasing and protection of rolled-iron beams, riveted girders, trusses, etc, and the encasing of the plumbing and gas-fitting, electric wires, etc.

VII. The construction of safety-closets, safety-furniture, safe-vaults and safes, as well as the building of stationary and removable family-safes.

VIII. The construction of a new sort of ocean ships and parts of war vessels, and many other things manufactured or built up not mentioned here will find a great help and improvement by the use of my "Phœnix-Construction," and among these the erection of very high fences or

UNITED STATES PATENT OFFICE.

C. LEO STAUB, OF PITTSBURG, PENNSYLVANIA.

CONSTRUCTION OF BUILDINGS, SHIPS, &c.

SPECIFICATION forming part of Letters Patent No. 277,952, dated May 22, 1883.

Application filed May 3, 1882. (No model.)

To all whom it may concern:

Be it known that I, C. LEO STAUB, a citizen of Switzerland, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Fire and Water Proof Structures; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 on Sheet 1 indicates a section of a fire and water proof floor and ceiling having separators fitted between the joists to divide the long air-space into compartments. Fig. 2 on Sheet 1 indicates a plan of the joists, separators, and compartments of the floor shown in Fig. 1. Fig. 3 indicates a vertical section through a hollow partition, and Fig. 4 on Sheet 1 indicates a horizontal section of the same with separators. Fig. 5 on Sheet 1 indicates a section through a strong fire and water proof floor, with open but protected joists or beams. Fig. 6 indicates a section through another fire and water proof floor, and Fig. 7 represents the plan of the top of the same. Fig. 8 indicates a sectional view of flooring, and illustrates a mode of fastening the same through the sheet metal to the sheathing or lower boards.

In Sheet 2, Fig. 1″ indicates a cross-section of a double fire-wall door, shutter, and elevator-hatchway door. Fig. 2″ indicates a section of a light-paneled partition. Fig. 3″ indicates an elevation of the same. Figs. 4″ and 5″ indicate, respectively, a vertical and a horizontal section of an incased rolled-iron beam for supporting the floor. Fig. 6″ indicates a horizontal section through a protected cast-iron column. Fig. 7″ indicates the section of a corner for a safe vault constructed of wood and sheet metal. Fig. 8″ indicates a detail drawing of a construction of the same.

Like letters of reference indicate like parts wherever they occur.

The object of my invention is to produce fire and water proof structures—such as buildings, ships, steamboats, freight-cars, furniture, and safe-vaults, &c—in a cheap, durable, economical, and efficient manner; and this object I have fully obtained by applying sheet metal entirely inclosed or incased with wood, and made as air-tight as possible, to such constructions, in the manner hereinafter set forth.

Heretofore, so far as I am aware, sheet metal has not been used in such a manner as to bring it up to the high standard it deserves as a protector against elementary influences. Generally it has been exposed directly to the action of fire, water, and air. Consequently, being a good conductor of heat, it offers little or no protection against fire when used as a covering for doors, shutters, &c., for experience has demonstrated that heavy wooden doors will keep the fire off for a longer time, on account of the non-conducting and slow-burning properties of such material, than it can be kept off by the use of ordinary iron-covered wooden doors, and when account is had of the facts that the metal in such cases is exposed directly to the decomposing influences of the air, water, and violence and to the general damage done by violence, sheet metal must be considered as the shortest-living building material.

fire

In regular fire-proof buildings composed of incombustible materials, the iron beams and girders, which are inclosed and vaulted in between with brick, terra-cotta, hollow tiles, concrete, &c., are subject to great expansion when exposed to a fierce heat, and thus cause a movement of the walls and the ultimate collapse of the fire-proof floor-arches. In order to overcome this and the defects previously referred to, I propose, in the use of my invention, to protect or entirely inclose the sheet metal with wood—that is, on both surfaces, and on the end with wood as air-tight as possible—so that it may serve for a long time through its splendid capacities—viz., first, as an air-tight material by taking off from the fire its greatest power—that is, the draft; second, as a water-tight material to save buildings and stored goods from damage from water, which is often greater than that caused by fire; third, to utilize its resistible strength and durability to fortify and stiffen constructions; fourth, to utilize its properties as a casing for girders, beams, columns, stone-work, &c., which are liable to great expansion from the influence of heat, and to rupture or disintegration from water during conflagrations.

granite

In the drawings, Fig. 1 indicates a water proof floor and fire-proof ceiling.

B indicates the flooring-boards, which are planed on all sides and are nailed to the joists

J while laid diagonally. L indicates rectangular plates of sheet-lead, which are laid in between the sheathing and flooring-boards, like flags—that is, their edges are not lapped over, but border each other—and these sheets L are soldered together at the joints to form a continuous level surface. The object of this arrangement is as follows: Lead will not corrode by the action of water; second, the sheets may be readily soldered together, so that the water may be entirely prevented from passing downward and injuring the ceiling; third, as the lead sheets do not lap each other their surface is level, allowing the boards to be readily and tightly screwed together, preventing air-spaces between them, and the lead is noiseless when persons are walking or goods are moved over the floor; and, finally, as the flooring rests upon a smooth level surface of sheet-lead it is prevented from springing or yielding during the movement of persons or goods over it. Consequently its fastenings are not loosened, and greater durability is obtained.

In the construction of the ceiling, plates S, of hard metal—as sheet-iron, steel, copper, &c.—are laid in a similar manner, and are fastened to the boards B with nails or screws, the joints being filled up to a level with iron or other hard and binding putty.

F indicates the boards which form the upper portion of the floor and the lower portion of the ceiling. These boards F are laid rectangular to the joists and are planed on all sides, but are not tongued and grooved in the usual way, but in the manner shown in Fig. 8, the tongue having a little more than the double length at its top, in order to allow the nails to be driven perpendicularly through the sheet metal, and not slant, as in the usual manner, as otherwise the nails are apt to bend on the surface of the sheets and prevent an air-tight joint between the boards and the metallic sheets. In securing these boards F screws are always preferred, as it is easier to secure a very tight joint with the plates.

It is evident that the application of my improved form of floors and ceilings to old or new buildings would afford considerable protection against damage by the action of fire and water; but the long air-spaces between the joists and the studding of the usual hollow partition form a terribly dangerous row of flues, and to this cause is due the rapid and unexpected spread of fires, so destructive not only to property, but also to human life. Therefore I break up these flues by dividing these long air-spaces into short compartments A by means of separators D, which are each formed of two pieces of board planed on all sides and inclosing a hard sheet-metal plate, S, of the same size between. To fix the position of the separators correctly, small pieces of wood, *c*, are nailed to the joists, and the separators D are nailed aslant to the joists against them, as is indicated clearly by the plan view of the joists shown by Fig. 2. The top and bottom of the joists, as well as the joints formed with the separators, should be planed smoothly to get rid of dangerous air-spaces, for it must be understood that usually the joints formed between rough-sawed timbers leave from one to three sixteenths of an inch, which is sufficient to admit the headway of the flames. The hollow partition shown in Figs. 3 and 4 is constructed upon the same principle. In the plan view, Fig. 4, T indicates the studding, which are to be planed on both sides against the boarding and on the joints formed with the separators D. These separators render the floors far stronger and stiffer than the usual way of cross-bridging, and the compartments A retard, break up, and deaden sound, thus taking up the place of the usual deafening materials, which often cause moisture and decay of the wood-work. The air-spaces between the carriages or supporting-joists of wooden stairways should also be divided into similar compartments and have the under side ceiled up, as shown in Fig. 1.

In Fig. 5 a fire-proof and water-proof floor, forming a ceiling and roof, also is shown. This is made of three layers of boards with two intermediate layers of sheet metal—viz., lead sheet L on top, for the hereinbefore-described purpose of affording a noiseless and inelastic casing, and steel, iron, copper, &c., sheet S below, laid exactly as before described. The heavy timbers J, forming the joists or beams, are protected air-tight with the hard-metal sheets S and the boards B; but this should only be done with thoroughly dry and seasoned timber, as otherwise it would cause decay or dry-rot. This inclosing with hard sheet metal and wooden boards should be applied as a protection to all wooden posts, columns, and heavy or combination beams and girders, and in particular where they are constantly exposed to moisture. The construction shown in Fig. 5 can also be used as a deck for steam boats and ships when the joists J are curved at the top, or are replaced by curved iron beams protected as shown by Fig. 4″ on Sheet 2.

In Fig. 6, which shows another form of fire and water proof floor, ceiling, and roof, the tongued and grooved boards F are laid diagonally and nailed or screwed to the rafters, joists, or beams. S indicates the hard sheet-metal layer, as before. P are wooden boards, from ten to eighteen inches wide, planed on all sides, with rabbeted ends and sides to receive, first, a lead plate, L, to make the floor water-proof by covering the joints of the wide boards P, and to then receive a hard-wood strip, H, of a trapezoidal form, so that a tight joint may be had when the latter is screwed down to the lower boards. Fig. 7 shows the top of this floor and the cross-grained joints *b* of the boards P, covered in the same way, so that an ornamental as well as a water and air tight surface and joint is secured.

Where the end or edges of the floors and partitions do not run against wood-work they should be provided with a grooved wooden frame, C, as shown in Fig. 1″, Sheet 2, so that

AMERICAN ARCHITECT AN
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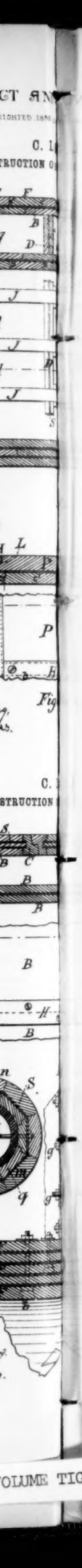
(No Model.)
C. L
CONSTRUCTION O
No. 277,952.
Fig. 1.
Fig. 2.
Fig. 5.
Fig. 6.
Fig. 7.
WITNESSES:
Fred. J. Kasterling,
Robert Hayes.
(No Model.)
C.
CONSTRUCTION
No. 277,952.
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 6.
Fig. 7.
WITNESSES:
Fred. J. Kasterling.
Robert Hayes.
VOLUME TIG



VOLUME TIGHTLY BOUND

No. 476 American Architect and Building News, Feb. 7 1885

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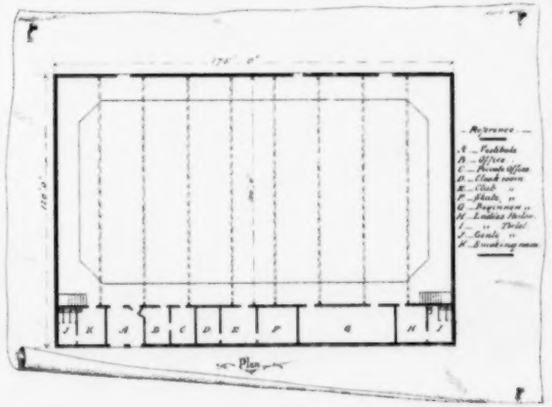
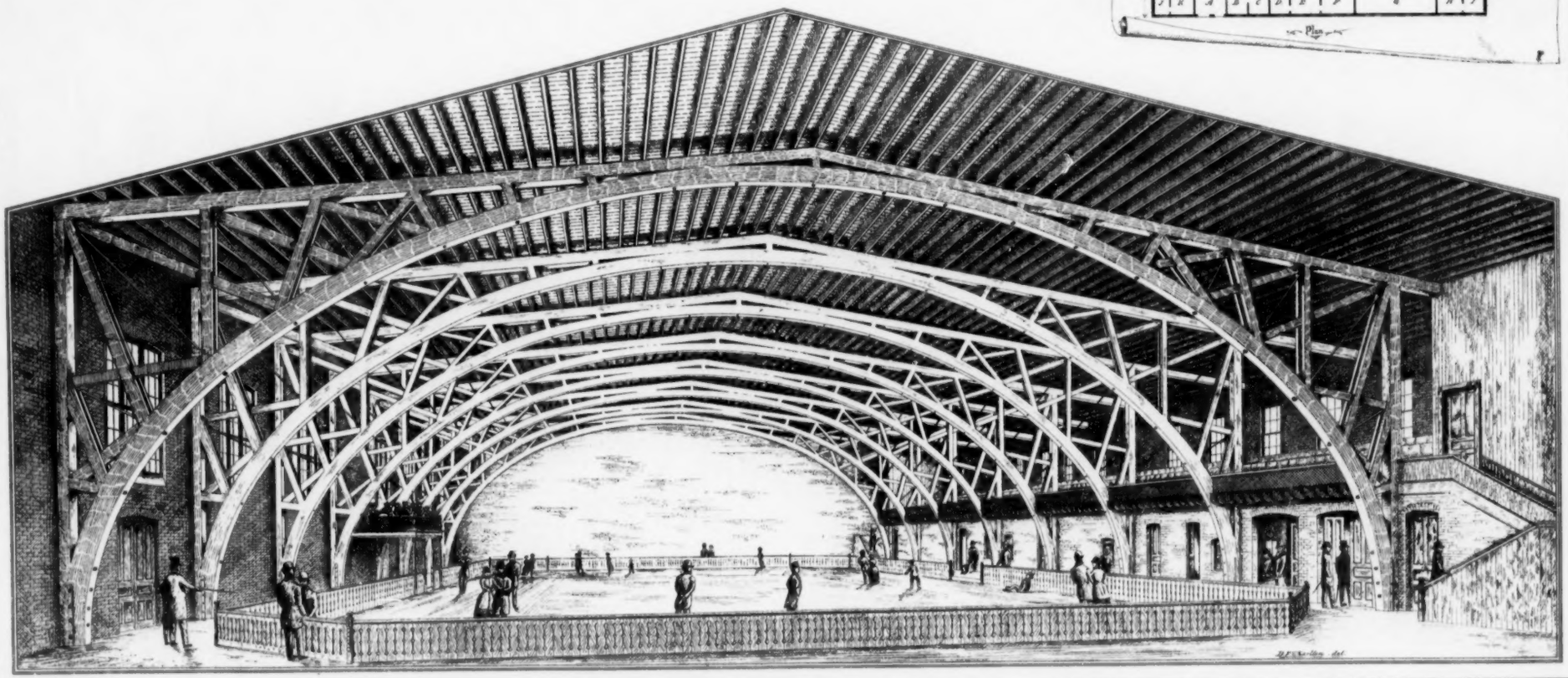
DETROIT ROLLER SKATING RINK.

erected by John. J. Bagley Estate. 1884.

— W. E. Brown. Arch't —
Detroit. Mich.





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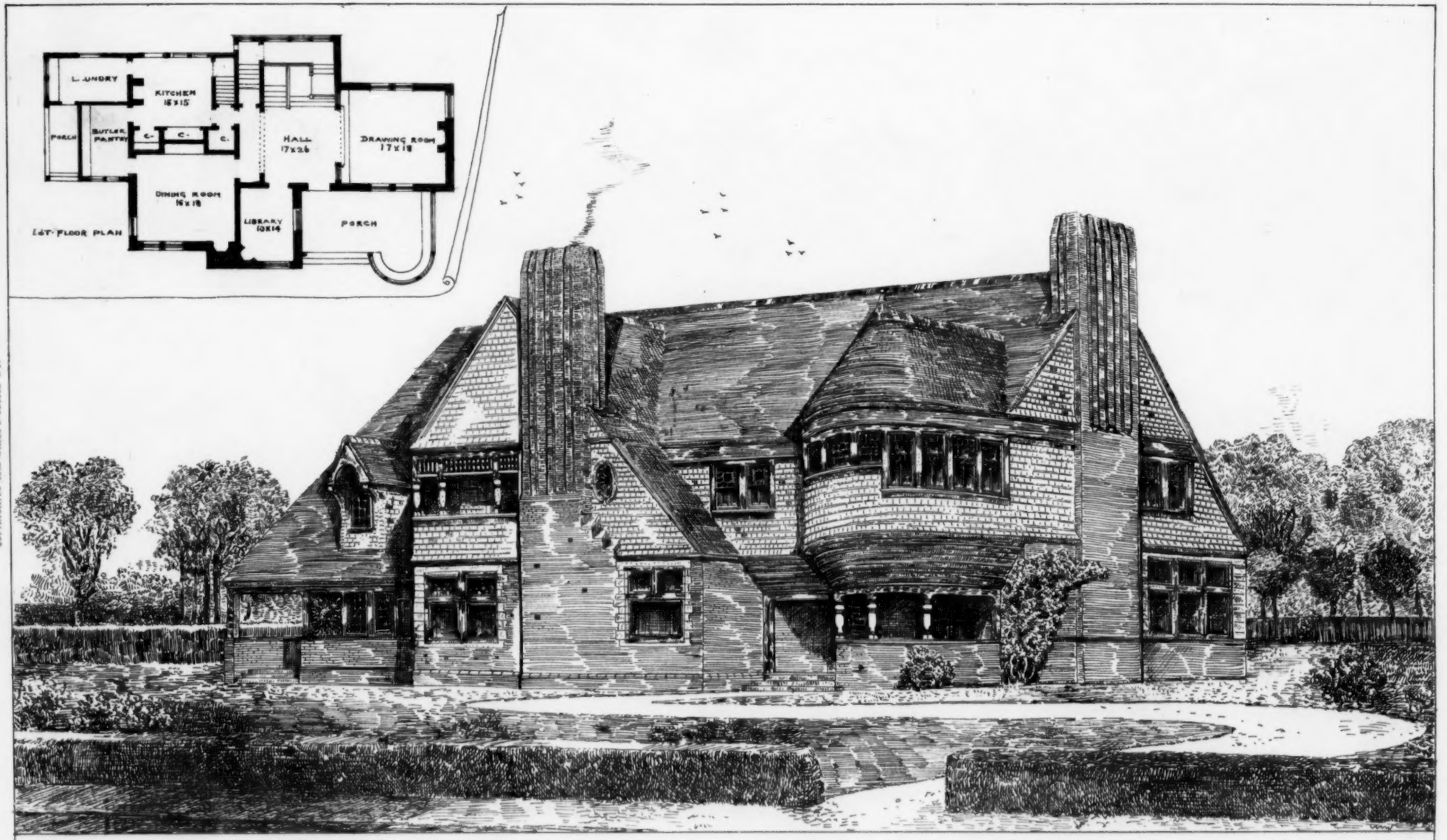

HOUSE in CHEYENNE, WY.

William A. Bates and Geo. D. Rainsford, Archts. 119 B'way, New York.

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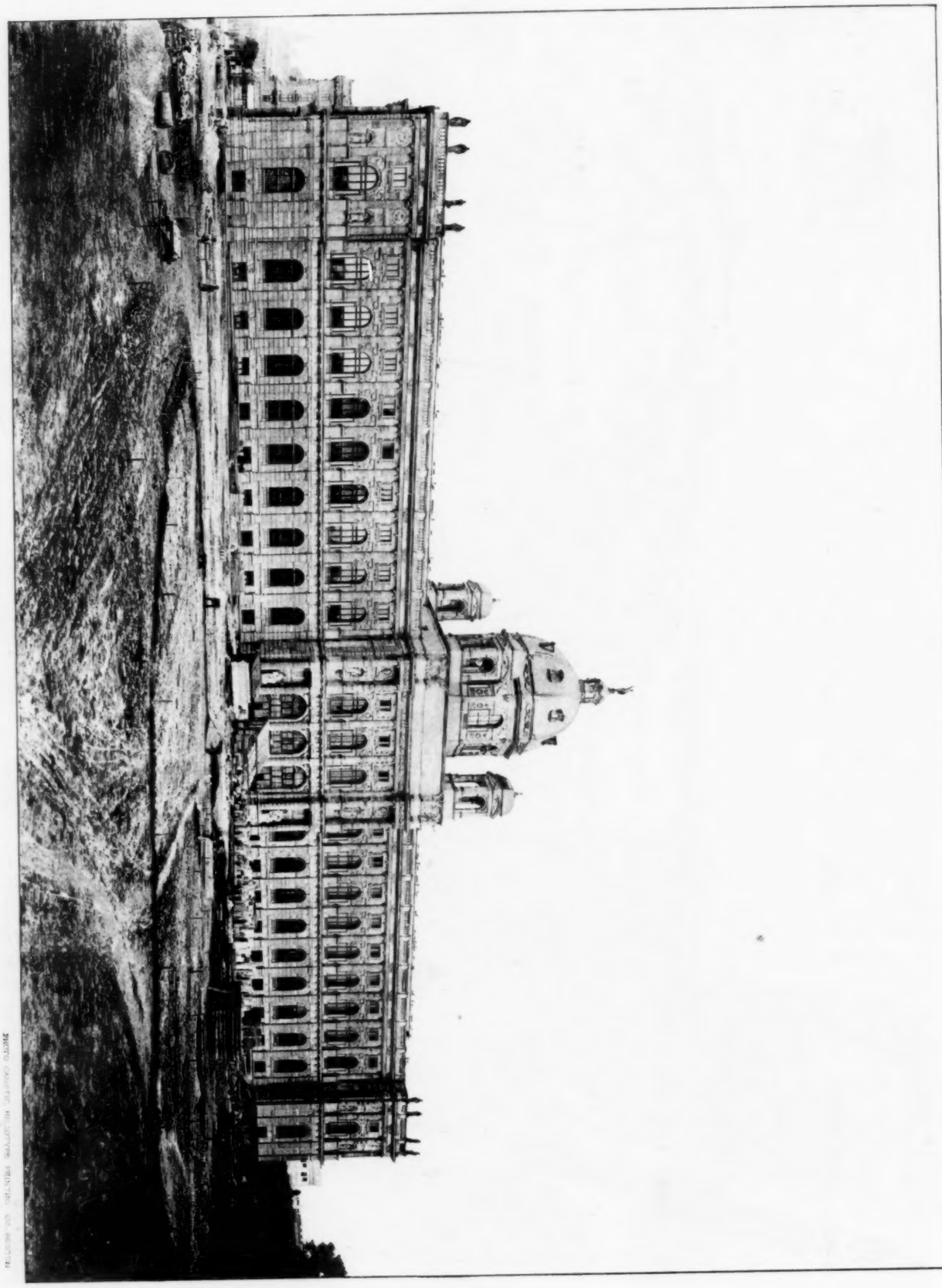

Museum of Natural History, Vienna, Austria.—1884.

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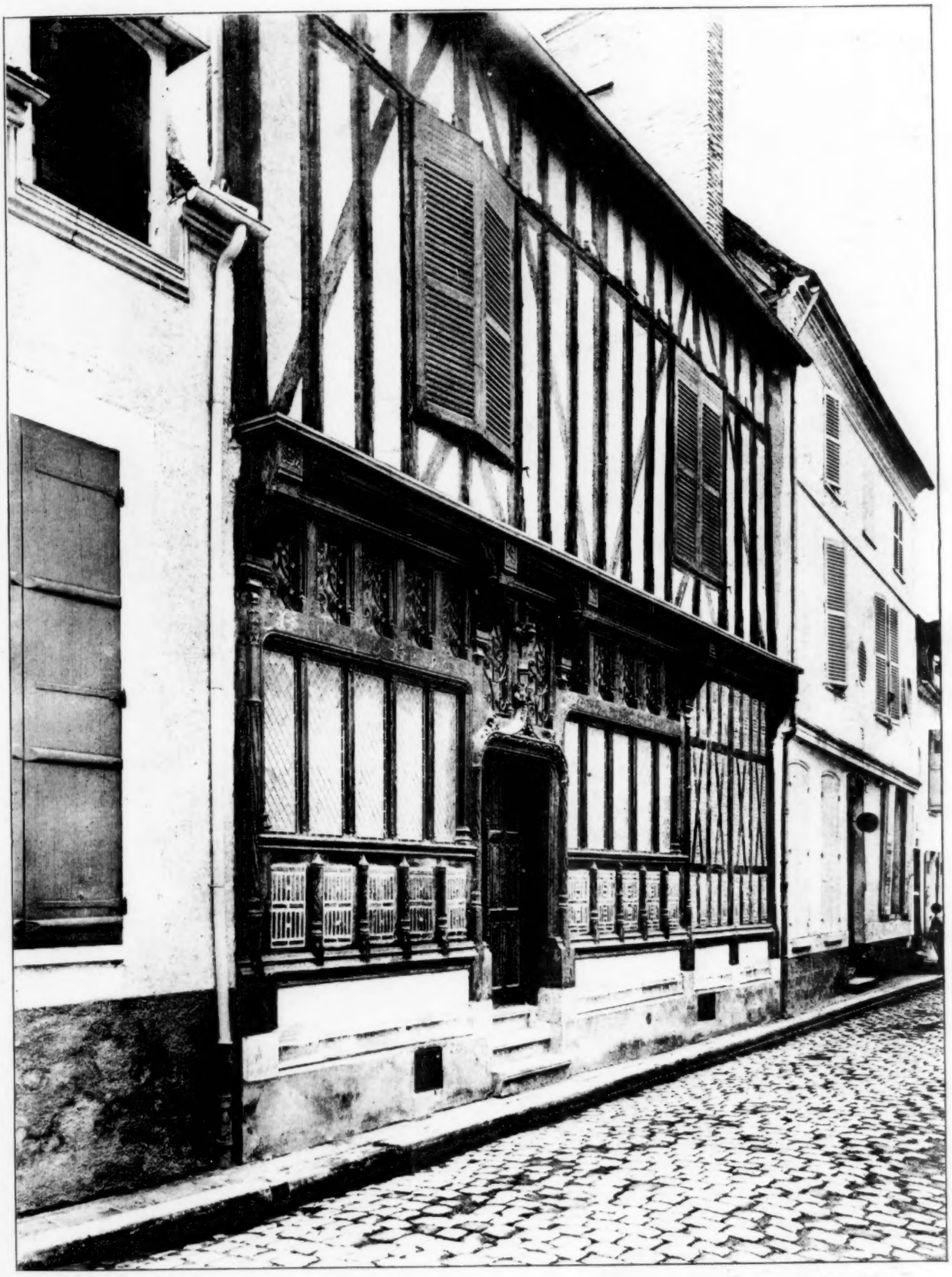

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La Caisse d Epargne, Sens, France - 1884

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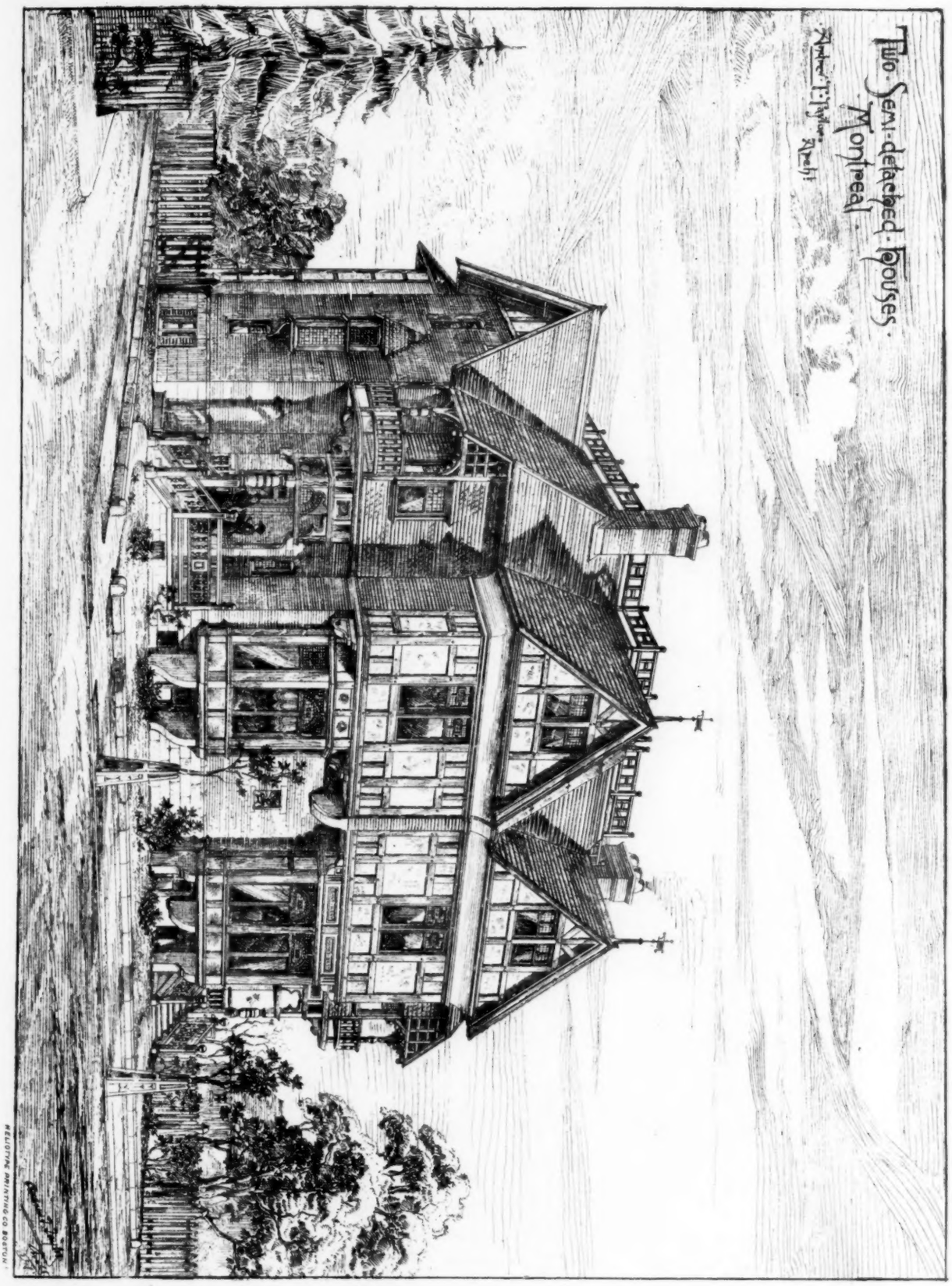

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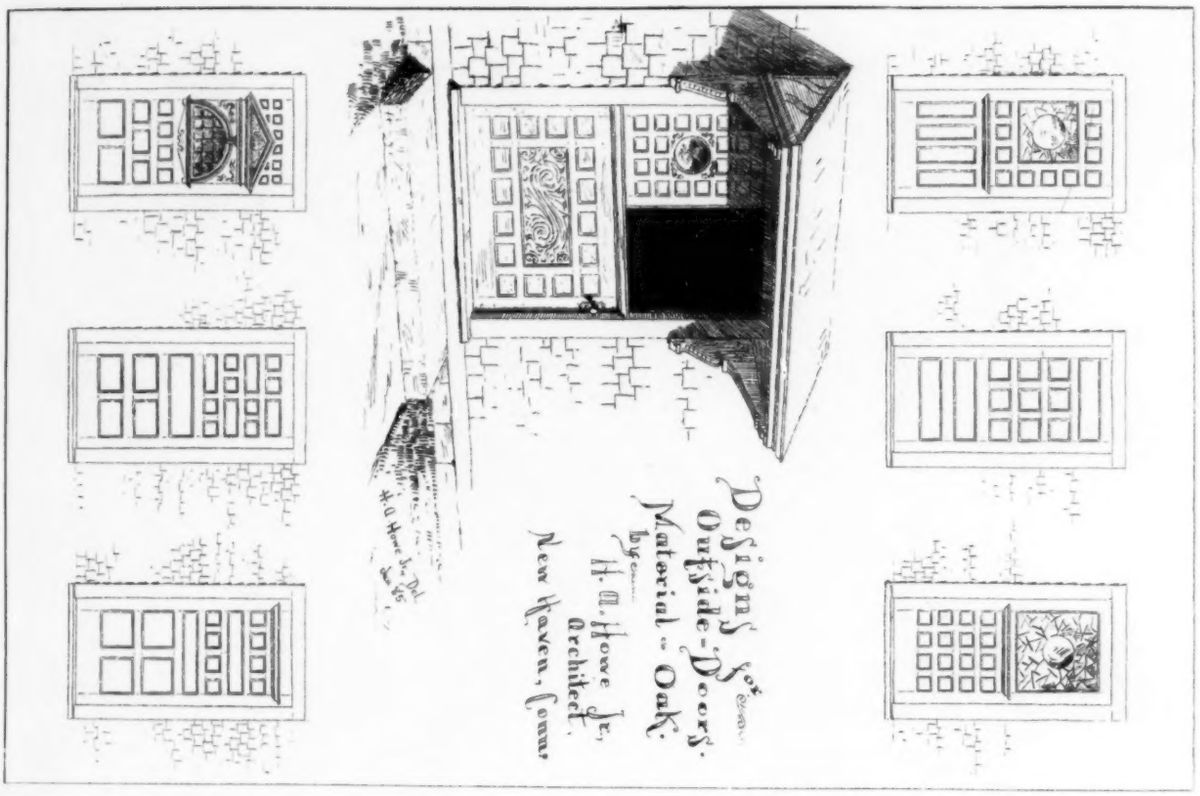

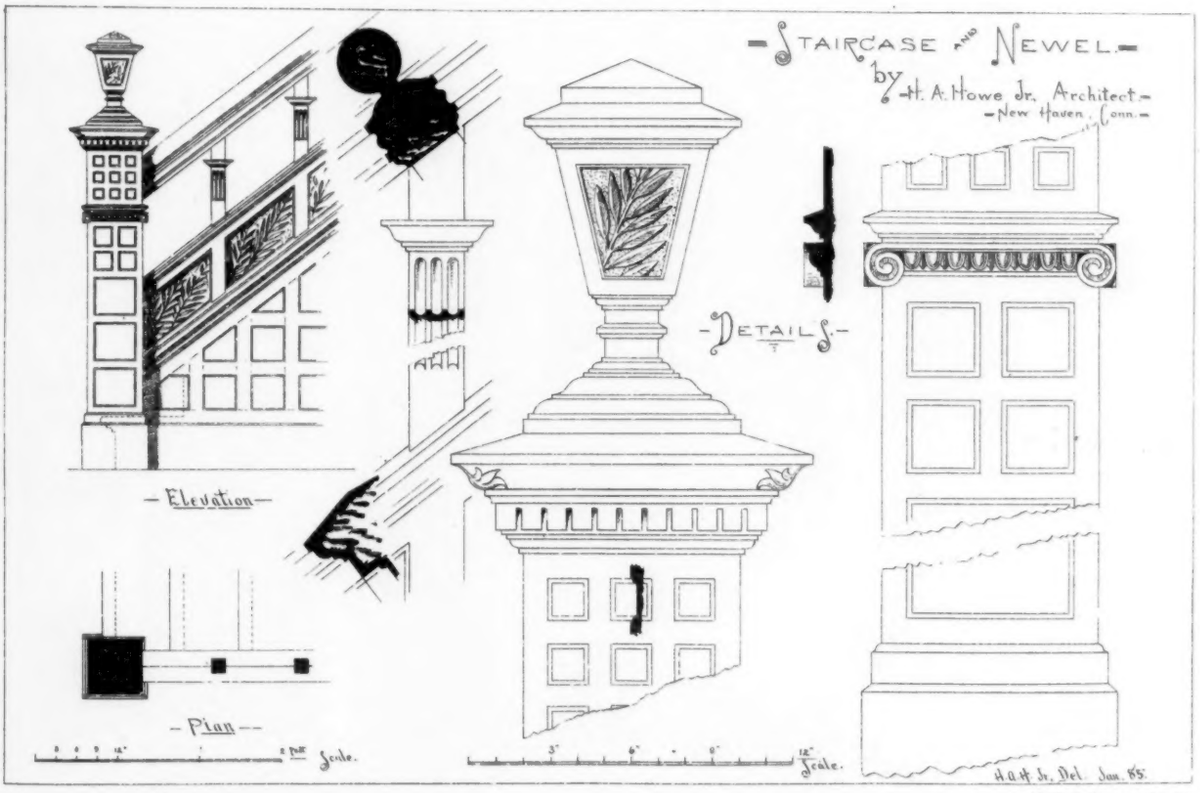

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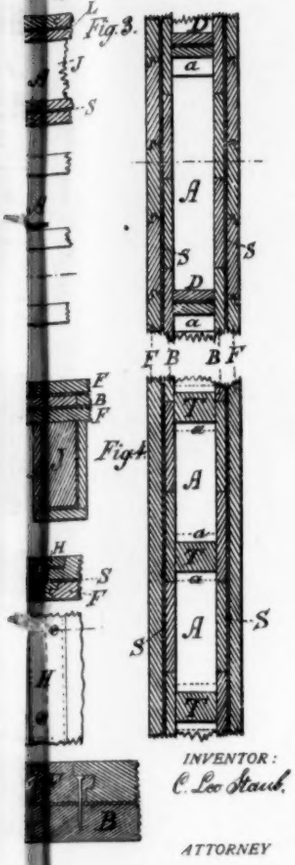
2 Sheets—Sheet 1.

TAUB.

BUILDINGS, SHIPS, &c.

Patented May 22, 1883.



INVENTOR:
C. Leo Staub.

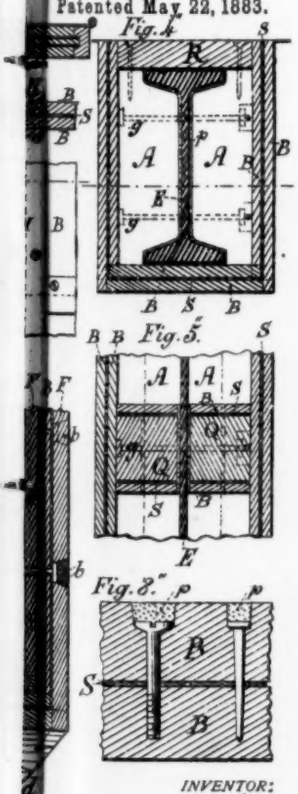
ATTORNEY

2 Sheets—Sheet 2.

TAUB

BUILDINGS, SHIPS, &c.

Patented May 22, 1883.



INVENTOR:
C. Leo Staub.

ATTORNEY

the sheet metal may be entirely inclosed in wood.

As it is important that particular care should be taken in the construction of doors, fire-walls, outside and inside shutters in warehouses, &c., and to close the elevators, shafts, and hatchways at each floor, I form a double door, as shown in Fig. 1″, Sheet 2, of three thicknesses of wood, B, and two intermediate plates, S, of hard sheet metal, the edges being protected on all sides by a grooved piece of hard wood, C, screwed and glued to the boards B, and the latter are joined together by screws or nails, as represented by Fig. 8″, same sheet, their heads being concealed and covered with putty *p*. This kind of fastening should be applied to each and all constructions, except in cases where other kinds are specifically mentioned.

When thin portions of wood are used to form the cabins, berths, and bulk-heads for passengers and crews of iron steamships and steamboats, as is usually the case, they become exceedingly dangerous, forming a row of tinder-boxes to feed the fire. Hence they and the doors and shutters used in said rooms should be built as shown in Figs. 2″ and 3″. (Shown on Sheet 2.)

Freight-cars and their partitions may be built in the same way, and may be provided with floors, as represented in Figs. 1 and 6 on Sheet 1, this mode forming thin and safe partitions when put upright, the outer boards being set perpendicular, and the inner boards horizontal. The roof of the car may be formed substantially in the same way, and the usual roofing may be fastened to it to protect the wood-work.

Iron constructions in general—as cast-iron columns, piers, rolled and wrought iron beams, girders, trusses, &c.—should be entirely protected with wood, or they and the structure which they support cannot be regarded as safe. For this reason I propose to protect beams as shown in Figs. 4″ and 5″ of Sheet 2, in which Q indicates pieces of wood planed on all sides and fastened to the beams E by means of the bolts *g*. As the iron beams have too rough a surface to allow the formation of air-tight joints, the spaces should be filled up with the putty *p*. A strong top board, R, should be spiked or screwed down onto the pieces Q to receive the flooring.

In cases of conflagrations, cast-iron piers and columns supporting whole store-houses, &c., become very hot, and when cold water is thrown upon them they are bound to burst, on account of the sudden and unequal reduction of their temperature and the consequent unequal shrinkage, thus causing the entire destruction of the building and its contents. Hence I protect them as shown in Fig. 6″ on Sheet 2. The cast-iron column E is incased first by the boards *q* and *n*, which are planed and rabbeted. While the boards *n* are grasping the boards *q* with their rabbet, the bolts *g* running through the cast-iron renders the whole thing solid and air-tight. The sheet metal S is then placed in position, and the outer boards are then secured, as shown by Fig. 8, care being had, however, that the sheet metal is first screwed or nailed into position as air-tight as possible. The side walls, piers, &c., are subject to explosion during a fire, if they are built of granite, and, if built of lime and other stones that cannot stand the fire, should be effectually protected through this improvement.

In Fig. 7″ a section of a corner of a safe-vault for buildings is shown, the vault being built with hard wood and inclosed sheet metal, S S S indicating the outer layers of metal, sheet or plate steel being used in this instance, and L indicating the inner layer of sheet-lead. Said inner sheets of lead, L, are used for the purpose of rendering possible the movement of articles within the vault without noise or springing of the sheets. The hard-wood tongued and grooved boards are laid rectangular alternately, and are bound at the corners by dovetailing *d*. In order to hold the wood and metal layers air-tight together, small and large bolts *g* are applied in such a manner that if the outer layers were to become destroyed by fire the inner portion would still form a water and fire proof vault, being secured by the smaller bolts. The outside hard wooden boards, F, will be fastened as is shown in Fig. 8″. All the bolts should grasp the steel plates directly with their heads, and the latter are to be protected by hard-wood pieces *b*, glued or puttied to the boards F. The doors of such vaults should be constructed in the same way; but all the rabbeted edges must be covered with hard wood to entirely cover the sheet metal on all sides, and to prevent the fire from attacking the steel and lead plates directly at their edges.

I am aware that it has been proposed to form a fire-proof floor by means of layers of boards and intermediate layers of sheet-iron lapped at the edges; but such a construction could not answer the purpose of my improvement on account of the following reasons: First, as the edges are lapped, the flooring would rest on the double thickness at the joints, and would give elsewhere when persons or goods moved over its surface, and this springing would soon loosen the fastenings and allow the upper boards to get out of place; second, the flooring would be liable to spring and open up at the ends of the boards, thus allowing water used for cleaning, &c., to sink down onto the metal, so that it would become destroyed in a very short time; third, the springing motion would cause the sheet-iron to give a noisy, disagreeable sound when persons or goods moved over the floor; fourth, the lapped edges are neither air nor water tight; and, finally, this construction leaves air-spaces between the sheet metal and the sheathing and flooring, which is a great defect, as

the sheets will buckle at the ends and allow free access of air between them in case of a fire; but,

Having described my invention, what I do claim, and desire to secure by Letters Patent, is—

1. In the construction of fire-proof structures, a fire-proof ceiling, panel, casing, or partition composed of two or more layers of boards enveloping an intermediate layer or layers of sheet metal, said sheets of metal being laid with their edges bordering or adjacent to each other, and joined and arranged substantially as specified, whereby close-fitting joints are secured between the layers, and air-spaces are avoided, substantially as and for the purpose set forth.

2. In the construction of fire and water proof structures, a water-proof floor, roof, or casing composed of layers of boards inclosing an intermediate metallic layer composed of sheets of lead laid with their edges bordering or adjacent to each other, and then soldered together to form a water-tight surface, substantially as and for the purpose specified.

3. In a fire-proof structure, the combination of a fire-proof ceiling composed of layers of boards enveloping an intermediate layer of sheets of iron or other hard metal, arranged with their edges bordering or adjacent to each other, and a water-proof floor composed of layers of boards enveloping an intermediate layer of sheets of lead having their edges soldered together, constructed and arranged substantially as and for the purpose specified.

4. In the construction of fire-proof structures, the combination of a fire-proof ceiling and water-proof floor, constructed and arranged as specified, with a series of separators which are each composed of pieces of wood enveloping a sheet of hard metal, and are arranged between the joists to divide their long air-spaces into short compartments, substantially as and for the purpose herein set forth.

5. In the construction of fire-proof buildings, the combination, with the floor and ceiling, of a series of separators which are each composed of layers of wood enveloping a sheet or plate of hard metal, and are arranged between the joists to divide their long air-spaces into short compartments, substantially as and for the purpose specified.

6. In the construction of fire-proof buildings, a fire and water proof floor, ceiling, or roof composed of an upper and a lower layer of boards inclosing an intermediate layer of sheet-iron or other hard metal, the upper layer of boards having rabbeted sides and ends, which receive a strip of sheet-lead, L, and a hard-wood strip, H, constructed and arranged substantially as and for the purpose specified.

C. LEO STAUB.

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dividing-walls between lumber yards, and between such properties where an everlasting danger from a sudden conflagration prevails.

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All such license-purchasers will please indicate the location and number of the respective building, and receive from me all the different patent drawings, with a full specification and general description, which enables any architect, carpenter and builder to proceed with these improvements immediately.

This low rate I propose to be current to the end of this patent year,—until the 22d day of May, 1885.

For assignments for whole or part interests, or to acquire an exclusive right, under my patent, for the whole or any specified part of the United States or territories, correspondence is solicited.

Very respectfully,
C. LEO STAUB, Architect and Patentee,
NEW YORK CITY.

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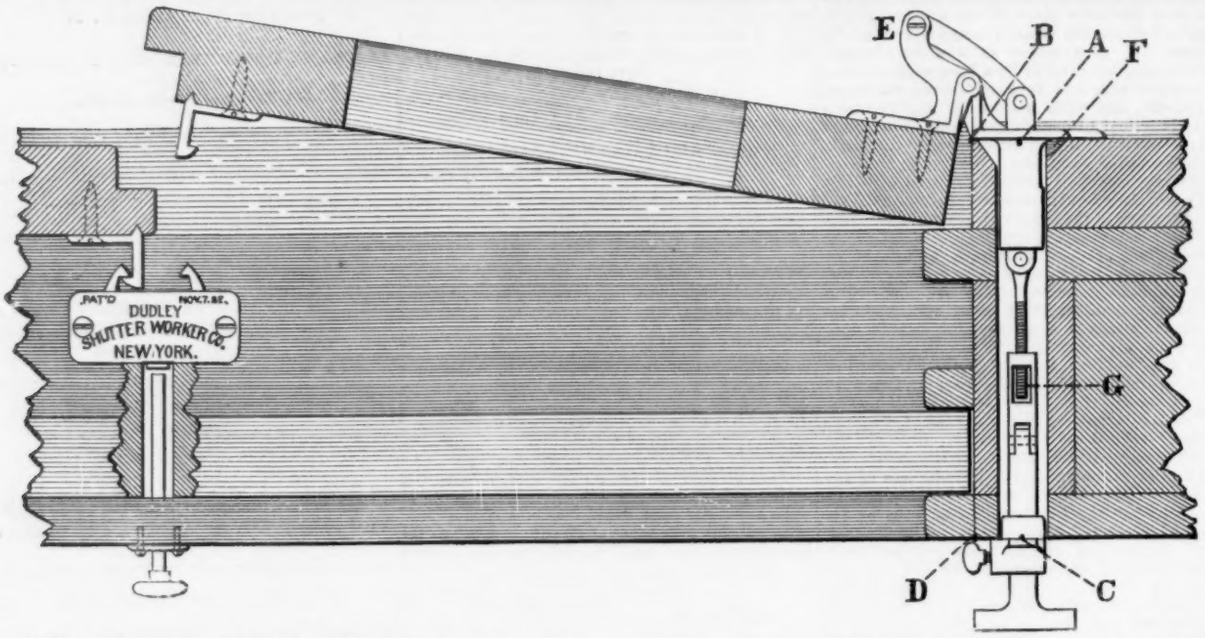

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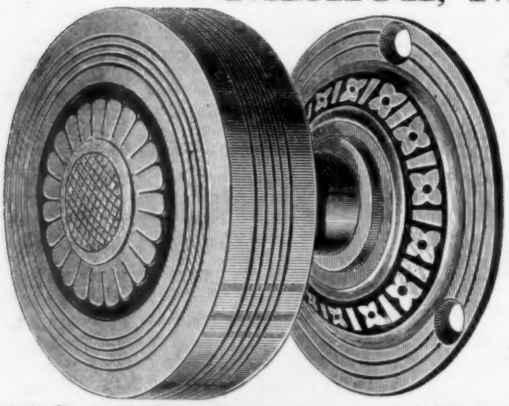

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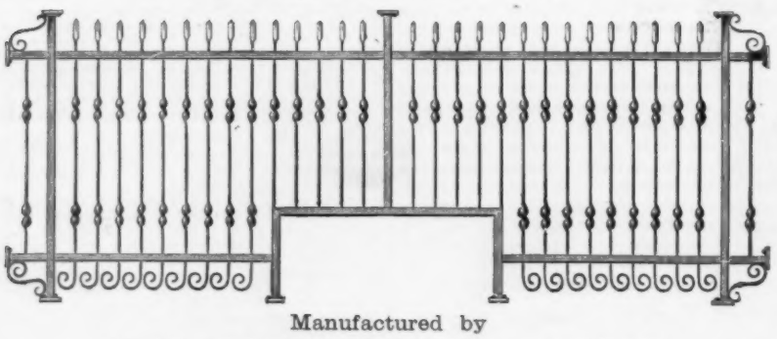

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with the clank of machinery. Trade and not art is the presiding goddess here; great foundries and ship-building yards abound, and acres upon acres of docks: all the interest is centred in these. Here are ironclads being built for the French Government, there great ocean steamers for the Compagnie Transatlantique, one of the best known of the French-American mail-lines to Mexico, and the West Indies. St. Nazaire is their sailing port, and in the docks lie several of their magnificent fleets; with their red funnels and great bulk they look like veritable Cunarders, and at sea it must be difficult to tell the difference. They make any one from ship-building England open his eyes and think: all the signs of a great seaport and a great future are here, and though we are told that the best workmen in the shipyards are English, that does not get over the fact of our red funnelled friends being here in abundance, so that he who runs had better read.

To the architect the only building of any interest in the place is the old church: it is probably of the sixteenth century or earlier in some parts; quite a seaport church with a good deal of timber in its construction. It has a great high-pitched roof tumbled about in curious fashion, and a wooden spire of the most picturesque sort. The whole group is more of a study for a painter than an architect, the roofs and walls being full of delicious gray and brown tints; its site is also most effective, and the houses cluster around it almost lovingly.

Internally the only subject of interest is a very fine reredos and altar of late seventeenth-century work; it is in colored marbles with sculptured figures, a good deal knocked perhaps, but still in good preservation, if only it were rid of the dirty lace and tawdry paper flowers with which it is bedecked, it might have a chance of going far to redeem an otherwise uninteresting interior. There are also traces of an older edifice to be seen in the round arches of the nave — or portion of the nave rather — and in the timber-work of the roof, a portion of which is evidently very much older than the rest.

St. Nazaire itself is a hot, sandy, dusty place in summer; it is in the position of a town which is growing, with partially laid-out streets and incomplete blocks of houses. Most of its people rush off at this season to cruise for sea-bathing, and we hardly wonder at it. It was with little regret, therefore, so far as St. Nazaire was concerned, that we found ourselves on board the steamer for England, and in the evening of another lovely day sailed down the few miles of the river and out over the bright waters of the Bay of Biscay towards Belle-Isle and home, but thoroughly delighted with our few days on the Loire. J. M. B.

THE ILLUSTRATIONS.

MUSEUM OF NATURAL HISTORY, VIENNA, AUSTRIA.

THIS view shows one of the twin buildings which form the last work upon which Gottfried Semper was engaged, in coöperation with von Hasenauer. The scheme of their designs included a series of triumphal arches which were to connect the museum buildings with the palace upon the other side of the street, so as to make a single composition of the several buildings.

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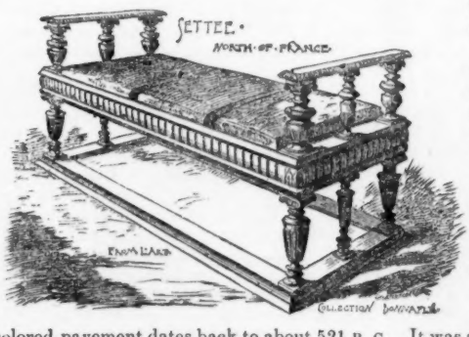

THE student of architectural pottery when he seeks to find the earliest examples in enamelled plastics naturally turns to Mesopotamia, and finds that the earliest positive record of a colored pavement dates back to about 521 B. C. It was at Susa, in the garden court of the Palace of Ahasuerus, who is probably the Xerxes of the Greeks, and is described as "a pavement of red and blue, and white and black marble."[1]

The art of enamelling in glazed colors was well understood by the people of this locality, at the time when the pavement was in use, as well as at an earlier period, as will appear from the description of the peculiar enamelled coffins which were used. Blue was a favorite color, and the red and blue of the pavement may have been enamelled tiles, and the white and black of marble. The colors employed by the ancient Egyptians were red, yellow, blue, sometimes green, and white and black, and these were the favorite colors employed in the architectural decorations of Nineveh and Babylon, and even after the lapse of centuries we find these same colors to-day predominantly employed.

It has been often stated that the floor of the Temple of Solomon was a colored pavement. The temple was finished nearly five hundred years earlier than the period already named, and it would be very interesting to know that the floor of this most beautiful building was so paved; but in Kings vi: 15, we are distinctly told that the floor of the temple was covered with planks of fir.

The history of colored pavements probably followed the high perfection in brick-making, which most flourished during periods of great extravagance. Diodorus of Siculus relates that the bricks of the walls of Babylon, erected under the orders of Semiramis were decorated with all kinds of living creatures portrayed in various colors upon the brick before they were burned.

An idea which was once popular, to the effect that the art of painting in enamelled colors, which afterwards became glazed or fixed to a clay body, originated about the ninth century with the Arabians in Spain, is clearly disproved by the glazed bricks of Babylon, the enamelled tiles from the ruined cities of the desert, and the colored, glazed coffins of those Assyrian cities of the dead discovered by Mr. Kennett Loftus. These enamelled coffins were in general use at Warka, Niffar, Zibizza, and other localities throughout Chaldea. In form, they resembled a slipper, but in symmetry and elegance they were models of beauty, their general design and finish displaying a high knowledge of the art of pottery. The body was placed in the coffin through an oval aperture near the head, which was afterwards sealed with a close fitting lid, cemented down with very fine lime mortar. In order to prevent the bursting of the coffin by the confined gases, a semicircular hole was left in the lower end. The top was divided into square panels by raised ridges, which were sometimes plain, and at others very ornamental; each panel or division was relieved by a similar diminutive embossed warrior, measuring about six and one-half inches. The small figure had its legs wide astride, a short sword belted on the left side, the arms akimbo, and the hands rested flat on a short fitting tunic. The head-dress was peculiar, and the general resemblance was similar to the figures on coins of the Parthian and Sassian periods. Glazing of rich green enamel covered the entire exterior surface of the coffin, and within the color was blue. The Arabs were attracted by the gold ornaments which these coffins contained, and often broke and despoiled them in large numbers.

The art of glazing in fixed colors came to us partially through the Arabians in Spain, who derived it from India, and primarily from China. It is certain that the art of enamelling in the Island of Majorca, where it reaches great perfection, was derived from the Arabians in Spain.

Glazed decorative tiles were much used in Mediæval times for paving sacred edifices; they were sometimes called Norman tiles by old writers, from the supposition that they originated in Normandy; although no tiles have as yet been discovered in England that coincide with the features of the Normon style of architectural decoration, the most ancient being apparently of the thirteenth century. The Normans were a race quick to seize upon every art that would add to the beauty of their buildings, either externally or to the interior; and after the return of the Crusaders in the twelfth century, many ornaments were added to their structures. When the Crusaders visited Byzantium, Palestine and Syria, they discovered buildings highly ornamented, and in which glazed tiles were used, and they were attracted by many of the architectural features. They carried back with them detail drawings of mouldings and designs, and among other things, glazed tiles, and most likely some knowledge of their manufacture.

The Abbey of Voulton near Provins, the hunting gallery of St. Louis at Fontainebleau, a chateau near Quimperlé, St. Etienné d'Agen, and many other buildings offer curious specimens of Norman tiles, and the employment of decorative tiles about the same period was not less common or much less brilliant in England.

Stone had supplied the wants of the Normans until the twelfth century; but from this time new ideas everywhere appeared at once; tiles of red earth of various forms were substituted for stone; their surfaces were covered with a thin layer of white clay, in which were incrusted patterns of darker earth or *vice versâ*. These baked enamelled tiles were not so easily worn by the constant steps of the faithful, as they were trodden every day in the vast naves of the churches by the feet of the Christian multitude.

The tiles were arranged in the pavements in a graceful chequer-work; trefoils, rosettes, and scrolls of notched leaves were formed and combined into graceful borders. Sections of divided circles were ornamented with stars or heraldic suns; warriors heavily armed, clad in armor, and mounted upon richly caparisoned horses,

[1] Esther i: 6.

were in active pursuit of one another; heads, busts, lions, eagles and all other things that fancy and heraldry could jointly invent, lent seeming life and animation to the cold pavements. Most of the ornamental combinations resembled the designs we are accustomed to see in the textile fabrics of the East; and we are of course the less astonished at this when we remember the visits of the Crusaders to Syria, Byzantium and Palestine, where this character of ornamentation was so largely employed from the ninth until the twelfth century.

The Normans even at that early date, believed not only in massive details of construction; but also in the cheerful effects of a harmonious combination of colors and designs for interior relief.

All the rich Norman mouldings were copied by the English, and most likely a great part of the knowledge of the employment and manufacture of glazed tiles was imparted to them by their Norman neighbors, who were a most energetic race; they took excessive delight in building; and their princes and nobles seem to have enjoyed their greatest pleasure in dwelling in and constantly beautifying their magnificent castles. But of course no credit can be claimed by the Normans for having originated glazed tiles, as this, like many other decorative arts of Western Europe was largely borrowed from the East by the Crusaders. Many of the early Norman glazed tiles correspond with features of Byzantine architecture, from which the Gothic styles are also drawn quite as freely as from the Roman.

The encaustic tiles of the Middle Ages were produced by a method wholly distinct from that now employed. The Norman tiles which have been mentioned are of this character; the process was commonly adopted and employed in northern Europe from the twelfth to the fifteenth century, after which tiles of this character fell into disuse. Parker states that the process of manufacture which, as it is supposed was commonly employed, may be described as follows: —

The thin squares of homogeneous clay having been moulded and allowed to dry gradually until of the proper firmness, a design in relief was impressed upon them, leaving the ornamental pattern in cavetto; into the hollows or depressions thus left upon the face of the tile, clay of another color was impressed: the clay usually employed for the last operation was white or pipe-clay. The tiles were fully and carefully dried, and then partly burned, after which they were finished by covering them with a thin surface of metallic glaze, which was of a slightly yellow color, and in the subsequent process of fixing this glaze in the furnace, the white clay beneath the glaze was tinged, and the red clay received a more full and rich tone of color. In order to facilitate the equal drying of the tiles as well as the burning, deep scorings or hollows were made on the reverse side, and in addition the pavement was more fully held together by the cement, the bond being stronger for it. The sizes of these tiles varied from about four to six inches square, and their ordinary thickness was about one inch. It was necessary that the shrinking nature of the clay should be about equal, and there is not the least doubt but that ingredients were used to act as a check upon the more fatty clays, or otherwise most of the designs would be full of cracks from unequal shrinking, or the surfaces would bulge and be thrown upwards. Imperfections of these characters are not wanting; but their general infrequence corroborates the statement that ingredients were employed to equalize the shrinkage in drying and in burning. Occasionally, either from the scarcity of white clay of suitable quality in some locations, or for the sake of variety, glazed tiles of this character occur which have the design left hollow, and not filled-in according to the usual process; but a careful examination of the disposition of the ornament will frequently show that the original intention was to fill these vacant cavities as in other specimens. But instances also occur when the ornamental design was evidently intended to remain in relief, the field and not the pattern being left in cavetto.

In the British Museum there is a portion of the pavement which was discovered in the ruined priory church at Castle Acre, Norfolk, and the glazed tiles which formed this pavement are among the oldest specimens employed in England. It has been stated that glazed tiles of superior make and finish have been discovered in the priory church at West Acre, Norfolk: this priory was founded by Ralph de Tony, in the reign of William Rufus, for canons of the order of St. Augustine.

The tiles from the pavement of the church in Castle Acre are ornamented with scutcheons of arms, and on some appear the name of "Thomas." The execution of these tiles is very coarse; clay of a different color was not employed to fill the cavities, and as a whole they are very much inferior to the Norman tiles of the same period.

The term encaustic has also been applied to glazed tiles of the kind in which the coloring ingredients are mixed with the clay, and were it not already applied to denote the antique process of art which has just been described, and which is so manifestly of a perfectly different nature, the term would not be inappropriate.

The name majolica is applied to all tiles or earthenware having the ornament in relief, the embossed ornament and ground being decorated with various colored enamels.

The art of manufacturing and enamelling majolica ware was lost for a long period, but in the fifteenth century, this ware and the art of imitating ancient productions were highly prized by the Italians, under the names majolica and *porcellana*, from the Portuguese word for a cup, and Robbia ware after the sculptor who re-discovered it.

The first manufactory of this ware possessed by the Italians was erected at Faienza, in the Ecclesiastical States, whence the French term *faïence*, now much used had its derivation. The body of the ware was usually a red clay, and the glaze was opaque; the oxides of lead and tin, mixed with potash and sand, were the usual ingredients employed in producing it.

This glaze was the re-discovery of Luca della Robbia, which, after the exercise of great patience and "experiments innumerable," he was able to apply not only mechanically, but with great artistic skill. Until he was past forty-five years of age Robbia's inclinations were towards sculpture, and both his finished and unfinished work of this period most decidedly establish his claim to a very high rank among Italian sculptors. Robbia executed one of the finest of the many cinque-cento tombs for the Bishop Benozzo-Federighi of Fiesole. A portion of the decorations of this tomb were enamelled tiles painted with fruits and flowers in their natural colors. Luca also introduced some changes by coloring his enamel for certain portions of the background, such as the plants, draperies, etc. He left a large number of these works, which are exquisitely beautiful. The secret of Robbia's method of enamelling was always carefully guarded, and after his death his family made a system of polychromatic architectural decorations, and the knowledge was a great fortune to them.

Robbia's son, Luca II and nephew Andrea, decorated the Ceppo Hospital at Pistoja, with a frieze which represents the seven acts of Mercy; the work required eleven years for its execution, and the effect is very pleasing as well as brilliant. Luca II was employed by Pope Leo X to pave the Loggie of the Vatican with colored glazed tiles. Two of Robbia's other sons, Girolamo and Giovanni, also worked in Robbia ware, the first named went to France and was much employed by Francis I in the decoration of his Chateau de Madrid, in the Bois de Boulogne.

Bernard Palissy, about the middle of the sixteenth century, which was a century later than the first productions of Luca della Robbia, manufactured a similar article, but differently ornamented, which is called "Palissy ware." This ware is remarkable for its faithful imitation of animals and plants, as well as for its beautiful and gently blended glaze.

The patience with which Palissy prosecuted the discovery of this ware, his fortitude under successive failures in ovens and in burnings, his hard labor, loss of credit and consequent poverty and suffering for more than sixteen years, display energy and courage of a high order, and seem much more like a romance than a reality. The small fishes, frogs, reptiles, and grasses, which he used in ornamenting the ware, were taken from the rivers, marshes and fields, and before they had time to wither were quickly cast in some rapidly-setting composition. The mould was then carefully divided in any number of desired parts, and the animal or grass which served as a model removed, the grease with which the object was covered, making this quite easy without injury to the cast. The place of final manufacture of Palissy ware was at Saintes in France.

Not long after Palissy, the Dutch produced a ware similar in designs to the Robbia and Palissy wares; it was very substantial and well made, and they called it Delft ware; but it was utterly destitute of those beautiful and gracefully expressive forms and paintings for which the Robbia ware of Faienza is so highly esteemed, and for which it will probably be remembered until the end of civilization.

The remarkable and beautiful pavement of the Château of Ecouen has often been ascribed to Italians, and the credit of producing these beautiful tiles is sometimes attributed to a member of the della Robbia family, at other times to a fugitive from the majolica manufactures, and some French writers have even credited them to the talent of Bernard Palissy.

There is not the slightest question as to the origin of these tiles; this indication of the place of their production is inscribed among the arabesques, A. Rouen, 1542, and the receipt of Masseot Abaquesne, enameller in earth, then living in the parish of Notre Dame de Sottevillelez, Rouen, for the final payment of this work was executed Thursday, March 7, 1548.

The reputation of Abaquesne had been made previous to the paving of the Château of Ecouen. In 1535, he decorated a "*salle faïencé*" at the hotel known as the "Logis du Roi" at Havre, and in the manor-house of Bévilliers, near Harfleur, a pavement almost similar, inscribed 1536. In 1557, Abaquesne gave a receipt in full and clear of all demands for the making of a certain number of enamelled tiles for the Sieur Durfe, as Governor of the Dauphin (later the young and short-lived Francis II), according to the designs which Durfe had given him for that purpose.

These tiles were possibly used in this "Château de la Faïencée," as Delorme styled it after being ousted from the direction of the works, and it is not at all unlikely that these same tiles found a place in the pavements of the château while under the direction of this identical Delorme in 1557.

In addition to the colored tiled pavements the interior walls of all Mediæval buildings were intended to be colored, and the color entered into and formed part of the original design, which in most cases has been lost from the practice of whitewashing them over, which so generally prevailed in the seventeenth and eighteenth centuries. Whenever this whitewash is removed carefully, the original coloring appears; but unfortunately in getting off the whitewash, the original thin coat of fine plaster which formed the *gesso* or ground to paint upon, is removed in company with it. In some instances the stone itself seems to have been painted upon, and the color mixed with wax varnish, which is impervious to moisture; and although these have been treated to repeated coats of the worse than senselessly applied whitewash, the coloring still reappears, seemingly in defiance of the ignorance which ordered its application.

STABILITY OF CHIMNEY-SHAFTS.

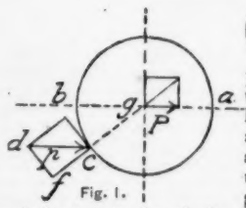

Fig. 1.

CHIMNEY-SHAFTS are exposed to the lateral pressure of the wind tending to overturn the structure. This pressure may be assumed to act horizontally, and to be of uniform intensity at all heights above the ground, without any appreciable error. The inclination of the surfaces of the chimney to the vertical is usually so small that it may be disregarded in estimating the pressure of the wind against the shaft. The greatest intensity of wind-pressure used to be taken by Rankine at 55 lbs. per square foot against a flat surface directly opposed to it. Although anemometers have registered much greater pressure than this, even as high as 80 lbs. per square foot, we have it on the authority of Messrs. Fowler and Baker that the records of anemometers, as at present obtained, are utterly misleading and valueless for all practical purposes, and a gauge was made in the presence of a Board of Trade Inspector to register 65 lbs. by the sudden application of a pressure not exceeding 20 lbs., the momentum of the index needle sufficing to cause the error. Mr. B. Baker, in his paper on the Forth Bridge, read before the British Association at Montreal, 1884, says: "Mr. Fowler and I are of opinion, therefore, as a result of our two years' further consideration, that the assumed pressure of 56 lbs. per square foot (recommended to be allowed for by the Board of Trade Committee on Wind-Pressure) is considerably in excess of anything likely to be realized."

The pressure of wind against a circular shaft may be taken as being equal to half the total pressure against a diametral section of that shaft. This result is obtained as follows: —

In Figure 1 let $d\,c = p$, the force of the wind acting parallel to the diameter $b\,a$. Resolve this force into its component parts, acting at right-angles to one another at the point c, one of them, $f\,c$, being a normal to the curve; we then have $f\,c$ as representing the force of the wind acting towards the centre of the shaft, and $f\,c = p \cos. \angle\, d\,c\,f$. Resolving this force, $f\,c$ at the point g, so as to measure the effective force exerted in the direction $g\,a$, parallel to the wind, we have the effective pressure $P = p \cos.^2 \angle\, c\,d\,f$. This angle $d\,c\,f$ ranges from 0° to 90°, and taking a sufficient number of angles we obtain $\cos.^2 \angle\, d\,c\,f =$ about .5, therefore the mean effective pressure of wind against the semi-circumference, $P = .5\,p$.

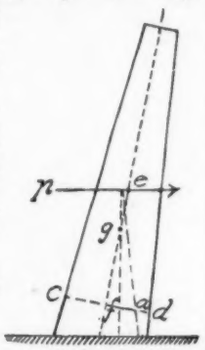

Fig. 2.

In this manner we obtain that if the pressure on a square shaft be taken = 1, that on a hexagonal shaft may be taken = .75, that on an octagonal shaft may be taken = .70, that on a circular shaft may be taken = .5.

If it is required to determine the stability of that portion of a chimney-shaft above the bed-joint $c\,d$, Figure 2,

Let A = the area of the diametral section of the shaft above $c\,d$, then the pressure of the wind against the shaft will equal

$$P = p\,A \text{ for a square chimney,}$$
$$P = .5\,p\,A \text{ for a round chimney,}$$

and its resultant may be taken as acting in a horizontal line through c, the centre of gravity of the diametral section. Let H represent the height of e above $c\,d$, then the overturning moment is: —

$$P\,H = p\,A\,H \text{ for a square chimney,}$$
$$P\,H = .5\,p\,A\,H \text{ for a round chimney,}$$

and the *least* moment of stability of the shaft above $c\,d$ should be equal to this.

It is evident that this lateral pressure of the wind will tend to move the centre of pressure on the joint $c\,d$, towards the lee side. It is found in practice advisable so to limit the deviation of the centre of pressure from the centre of figure, that the maximum intensity of pressure at the leeward side shall not exceed twice the mean intensity. Let q denote the ratio which the distance of this deviation bears to the length of the joint $c\,d$, then we have the following value as given by Rankine: —

$$\text{For square chimneys } q = \tfrac{1}{3},$$
$$\text{For round chimneys } q = \tfrac{1}{4},$$

which is practically taking a factor of safety of 2 for round shafts, and $\frac{3}{2}$ for square shafts.

If we take a chimney the axis of which is not vertical, as in Figure 2, it is evident that the least moment of stability is that which resists the overturning action of the wind in the direction in which the shaft leans. Let g be the centre of gravity of the part of the shaft above $c\,d$, f a point in the joint $c\,d$, vertically below g, a the limit of deviation of the centre of pressure, j equal the length of $c\,d$, q^1 the ratio which the deviation of f from the middle of joint bears to j, W the weight of the shaft above $c\,d$; all the values being in feet and pounds; then the *least* moment of stability is

$$W \times f\,a = W\,(q - q^1)\,j,$$

which should equal the moment of wind pressure. Therefore we have the equation: —

$$P\,H = W\,(q - q^1)\,j.$$

Substituting the values of $P\,H$ and q, this becomes: —

$$p\,A\,H = W\,(\tfrac{1}{3} - q^1)\,j \text{ for square chimneys,}$$
$$\frac{p\,A\,H}{2} = W(\tfrac{1}{4} - q^1)\,j \text{ for round chimneys.}$$

Let T be the mean thickness of the brickwork above the joint $c\,d$, and t the thickness to which the brickwork would be reduced if spread out upon a flat area equal to the external area of the shaft. This reduced thickness is given approximately by: —

$$t = T\left(\frac{i - T}{j}\right).$$

In most cases, however, the difference between T and t may be neglected.

If w be the weight of a cubic foot of brickwork = 112 lbs. generally, we have: —

$$W = 4\,A\,t\,w \text{ for square shafts,}$$
$$W = 3.14\,A\,t\,w \text{ for round shafts,}$$

and substituting these values in the equations above given, we obtain:

$$p\,H = (\tfrac{1}{3} - 4\,q^1)\,t\,w\,j \text{ for square chimneys,}$$
$$p\,H = (1.57 - 6.28\,q^1)\,t\,w\,j \text{ for round chimneys.}$$

If we consider the chimney to stand vertically on its base, this becomes: —

$$p\,H = \tfrac{1}{3}\,t\,w\,j \text{ for square shafts,}$$
$$p\,H = 1.57\,t\,w\,j \text{ for round shafts.}$$

In the above formulæ the tenacity of the mortar has been disregarded, and it should never be taken into consideration in designing new shafts, as many months from the erection must elapse before the tenacity of the mortar is appreciable.

The foregoing formulæ enables us to determine the greatest pressure a shaft will withstand when we have the dimensions, forms, and thicknesses of the masonry or brickwork of the chimney given, and also to find the value of t for each bed-joint when we have the pressure of the wind p and the external form and dimensions of the chimney given.

A chimney-shaft consists of a series of sections one above the other, each section being of uniform thickness, and each succeeding section diminishing in thickness from that immediately below it, and it is obvious that the bed-joints dividing the sections have less stability than the intermediate ones; hence it is only necessary to apply the formulæ to the former set of joints, including the joint at the ground line.

The stability against wind of Messrs. Tennant & Co.'s chimney, St. Rollox, Glasgow, Prof. Rankine determined by the formulæ herein given. — *From Chimney Construction, by R. M. Bancroft and F. J. Bancroft*, 1885.

DEATH OF EASTBURN HASTINGS, A. A. I. A.

AMERICAN INSTITUTE OF ARCHITECTS,
SECRETARY'S OFFICE, 110 CATHERINE STREET,
NEWPORT, R. I., January 28, 1885.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — At a quarterly meeting of the Board of Trustees A. I. A., held at the Bryant Building, in the City of New York, on Wednesday, the 21st inst., the Secretary stated that he was in receipt of a letter from the family of Mr. Eastburn Hastings, an Associate of the Institute, conveying the intelligence of his decease on the 11th of September, 1884.

On motion, Mr. Henry M. Congdon was appointed a committee to prepare a minute of sympathy and respect. The following resolutions were presented by Mr. Congdon and adopted: —

Resolved,—That the Board of Trustees, having heard with regret of the death, on the 11th of September, 1884, of Mr. Eastburn Hastings, long time Associate of the American Institute of Architects, desire hereby to express to his family their sense of the loss of one of their members, and their sincere sympathy with the relatives who mourn his decease.

It was also resolved that a committee be appointed to communicate this resolution to his family; that it be spread upon the minutes of the Board of Trustees and a copy forwarded to the *American Architect* for publication. Respectfully, GEO. C. MASON, JR.,
Secretary, A. I. A.

KEENE'S CEMENT.

HULL, P. Q., January 29, 1885.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs,—I notice in your paper, the *American Architect*, which I get through Durie & Son, Ottawa, the advertisement of Keene's Cement, coarse and superfine. Please, if you possess the knowledge, give me an analysis of it, with the difference between the coarse and superfine. In case you cannot supply the required information, please let me know who can, or if there is any book or work treating upon the same, and greatly oblige,

Yours very respectfully, C. B. WRIGHT.

[KEENE'S cement is of great service in furnishing the interior of fireproof buildings, as can be seen at the Museum of Fine Arts, Boston, the Morse Building in New York, and many others. The coarse is perhaps the most serviceable for upper works, as it is white and capable of receiving a

hard polish, while the superfine, as it is harder when set, is most suitable for skirtings, door finish, etc., and as both kinds are commonly painted, its inequality of color is not a material disadvantage. Both grades are prepared from plaster-of-Paris, as follows: In a saturated solution of alum, made by dissolving in a gallon of water one pound of alum, are soaked eighty-four pounds of calcined plaster-of-Paris, introduced in small lumps; after being exposed to the air for eight days, the plaster is recalcined at a dull-red heat and then ground. A half-pound of copperas added to the cement gives it a cream color, and is said to increase its power of resisting atmospheric influences.—Eds. American Architect.]

FIRE-PROOF BUILDING.

Boston, Mass., January 26, 1885.

To the Editors of the American Architect: —

Dear Sirs, — "E. A." in a recent number inquires for plans of fire-proof schools and churches. It is easier to make plans for such than to get the public to pay for the extra cost of fire-proof building at the outset. It is considered cheaper to frame the walls with studs 2″ x 4″, 12″ apart, and form a series of flues, good vents for fire, all round, than to use heavier studs at wide intervals, with the space filled in with slabs of cement-concrete, as done by Lascelles & Co., of London. Plastering exteriors of frame buildings would be a step nearer fire-proof construction. R. B., Jr.

WHERE TO RUN A SOIL-PIPE.

Newark, N. J., January 14, 1885.

To the Editors of the American Architect: —

Dear Sirs, — Will you kindly inform me if it is better to place a three-inch iron soil-pipe between the plaster and boards of a frame building or on the inside of plaster, where it will be exposed to view?

Yours truly, A. Connelly.

[Inside, if it can be arranged so as not to cause too great disfiguration of the rooms. If it must go between the studs, it should be so arranged as to be accessible for its full height from the inside. — Eds. American Architect.]

A HISTORY OF ROMAN ARCHITECTURE.

Denver, Col.

To the Editors of the American Architect: —

Dear Sirs,—You will greatly oblige by informing me, through your paper, which are the best books on the "History of Roman Architecture," from its earliest stage. Very faithfully,

Roman.

[We confess to being seriously puzzled as to what is the proper answer to give to this apparently simple question. If "Roman" reads French, he may find Batissier's "*Histoire de l'Art Monumental*" as much to his purpose as anything which can be found within a single cover. — Eds. American Architect.]

GLUE-WATER IN MIXING STUCCO.

Fort Dodge, Iowa, January 26, 1885.

To the Editors of the American Architect: —

Dear Sirs,—What knowledge have you of the use of glue and sand in the mixing of mortar made of stucco and plaster (gypsum) for rough or first coat work?

In this country for a number of years we have used for rough or first-coat work in plastering a mortar made of the above materials in the following proportions: one-third stucco, two-thirds sand, mixed with a solution of glue in water, to retard the setting of the mortar (about four quarts of glue-water to the one hundred pounds stucco) and we desire to ascertain how long these materials have been used in connection with stucco for making mortar.

How long has glue-water been in use as a retarder in connection with stucco? How long have sand, ground coke or cinders been used in mixing mortar with stucco?

Give us all the information you have in connection with these materials for mortar, and send your bill to us.

Very respectfully, S. S. Marsh.

[We have never heard of the use of glue for the purpose our correspondent describes, and can find no mention of it in the books, but think it not unlikely that it may be more or less familiar to stucco-workers. At any rate we should think it might have suggested itself, through accidental observation, to some one of the many who habitually use glue moulds in their work. If it is a novelty, there will probably be many who will welcome and profit by the hint now given. We imagine that the other materials used in mixing mortar with stucco date from time immemorial. If any of our readers possess more definite information, they have here an opportunity to air it and "send in their bill." — Eds. American Architect.]

NOTES AND CLIPPINGS.

The Ailantus. — Many complaints have been made of the overpowering and offensive odor of the flowers of the ailantus trees planted in the streets of Paris and other large cities. According to M. E. André, it is only the flowers of the male trees which exhale this unpleasant scent, and he recommends that none but female trees should be for the future planted in public or other places where the peculiar odor of the males might be offensive. This would seem an important point for Americans and others who plant the Ailantus largely as a street tree. — *Woods and Forests.*

The New Commissioner of Labor Statistics. — The President has nominated Col. Carrol D. Wright, of Massachusetts, to be Commissioner of Labor Statistics.

An Architect's Suit. — The action of James K. Wilson, architect. against D. Webster Lane and George Boshart was tried lately before Judge Koon and a jury. Mr. Wilson alleged that in the summer of 1884 he performed work for the defendants in drafting the preliminary sketches and drawing the plans and specifications for a building proposed to be erected at the corner of Nicollet avenue and Ninth street. This labor was worth the sum of $840. This sum is unpaid as yet, and action is brought for the full amount. The defendants, answering, allege that the work was not worth $840; that before it was commenced at all they positively stated to the plaintiff that they did not wish to do anything about the building unless it could be erected for $20,000, and they did not wish him to begin the plans or do anything, in fact, unless he would take the chance of losing his work in case the building could not be put up for that sum. The contract was definite on this point. Mr. Wilson then went to work and completed his plans, but by his own confession a building could not be put up according to them short of $35,000. They were therefore abandoned. The testimony adduced in the trial of the action seemed to establish this fact. The jury returned a verdict for defendants. — *St. Paul Pioneer Press.*

The Pullman Sewage-Farm. — The Pullman sewage-farm, and the results attained upon it, have received wide attention. As is pretty generally known, the Pullman farm is probably the most extensive example of the purification of sewage by the downward intermittent filtration system now in operation. The farm is situated three miles south of the city of Pullman, the sewage of which it receives, and to which it is conveyed through a large iron pipe. The farm has been in operation three years. In 1883, the produce was as follows: cabbage, 120,000 heads; potatoes, 7,958 bushels; onions, 1,000 bushels; squash, ten tons; turnips, 100 bushels; celery, 8,200 dozen bunches. In 1884 the yield has been: cabbage, 200,000 heads; potatoes, 6,400 bushels; onions, 3,500 bushels; squash, forty-five tons; turnips, 500 bushels; celery, 18,000 dozen bunches. This shows a decided increase in everything except potatoes, due largely to the increased skill acquired in the management of the farm and the application of the sewage. Full cars of produce have been shipped to various large cities, such as Vicksburg, Pittsburg, New Orleans, Atlanta, and Memphis. Orders have been shipped as far east as Hartford, and south as far as Galveston. There has recently been established on the farm a sauerkraut manufactory, and it is probable that a large quantity of this favorite composition will be manufactured. There is a dairy supplied by Holstein cattle on the farm. The undrained land, some of which was sown to oats, yielded twenty-two bushels to the acre in 1884. One hundred tons of hay were cut. About forty farm hands were employed this year. The superintendent of the farm sells the produce himself, no middlemen being allowed to manipulate it. The crop of 1883 paid 8 per cent on the investment; the crop of 1884 was larger, but the prices prevailing were somewhat lower. There is no question about the success of this farm, and its history is a valuable one for the numerous cities now considering the question of how to get rid of sewage. — *The Sanitary News.*

Cements for Special Purposes. — The value of a cement is, first, that it should become a strongly cohering medium between the substances joined; and, second, that it should withstand the action of heat, or any solvent action of water or acids. Cement often fails in regard to the last consideration. For waterproof uses several mixtures are recommended, and the following may be mentioned: one is to mix white lead, red lead, and boiled oil, together with good size, to the consistency of putty; another is powdered resin, one ounce, dissolved in ten ounces of strong ammonia; gelatine, five parts, solution of acid chromate of lime, one part. Exposing the article to sunlight is useful for some purposes. A waterproof paste cement is said to be made by adding to hot starch paste half its weight of turpentine and a small piece of alum. As a cement lining for cisterns, powdered brick two, quicklime two, wood-ashes two, made into a paste, with boilod oil, is recommended. The following are cements for steam and water joints: ground litharge, ten pounds; plaster-of-Paris, four pounds; yellow ochre, one-half pound; red lead, two pounds; hemp, cut into one-half inch lengths, one-half ounce, mixed with boiled linseed oil to the consistency of putty. White lead, ten parts; black oxide of manganese, three; litharge, one; mix with boiled linseed oil. A cement for joints to resist great heat is made thus: asbestos powder, made into a thick paste, with liquid silicate of soda. For coating acid troughs, a mixture of one part pitch, one part resin, and one part plaster-of-Paris is melted, and is said to be a good cement coating. Correspondents frequently ask for a good cement for fixing iron bars into stone in lieu of lead, and nothing better is known than a compound of equal parts of sulphur and pitch. A good cement for stoves and ranges is made of fire-clay with a solution of silicate of soda. A glue to resist damp can be prepared with boiled linseed oil and ordinary glue; or by melting one pound of glue in two quarts of skimmed milk; shellac, four ounces; borax, one ounce, boiled in a little water, and concentrated by heat to a paste. A cement to resist white heat may be usefully mentioned here: pulverized clay, four parts; plumbago, two; iron-filings, free from oxide, two; peroxide of manganese, one; borax, one-half, sea-salt, one-half; mix with water to thick paste, use immediately, and heat gradually to a nearly white heat. Many of the cements used which are exposed to great heat fail from the expansion of one or more ingredients in them, and an unequal stress is produced; or the two substances united have unequal rates of expansibility or contractility; the chemical or galvanic action is important. The whole subject of cements has not received the attention it deserves from practical men. Only Portland cement has received anything like scientific notice, and a few experiments upon water-proof, heat-resisting and other cements would show which cements are the best to use under certain circumstances.—*Building News.*

BUILDING INTELLIGENCE.

(Reported for The American Architect and Building News.)

[Although a large portion of the building intelligence is provided by their regular correspondents, the editors greatly desire to receive voluntary information, especially from the smaller and outlying towns.]

BUILDING PATENTS.

[Printed specifications of any patents here mentioned, together with full detail illustrations, may be obtained of the Commissioner of Patents, at Washington, for twenty-five cents.]

211,165. SKELETON TOWER. — John S. Adams, Elgin, Ill.

311,166. ELECTRIC-LIGHT TOWER.—John S. Adams, Elgin, Ill.

311,167. IRON GRATING. — John S. Adams, Elgin, Ill.

311,178. EXPANSION-JOINT FOR STEAM AND OTHER PIPES. — T. W. Duffy, New York, N. Y.

311,192. AUTOMATICALLY DISINFECTING WATER-CLOSETS, URINALS, ETC. — Wm. J. Longley, Mount Vernon, N. Y.

311,202. WRENCH. — Washington L. Parker, Spartanburg, S. C.

311,204 FIRE-EXTINGUISHER.— John S. Shrawder, Upper Dublin, Pa.

311,205. WATER-COCK ATTACHMENT. — Lawrence Shuster, Jr., Philadelphia, Pa.

311,207. WATER-CLOSET TANK OR CISTERN. — Michael J. Smith, New York, N. Y.

311,221. LEVELLING-ROD. — Henry F. Bean, Jackson, Mich.

311,239. COMBINED FIRE-ESCAPE LADDER AND VENTILATING-FLUE. — James W. Evans, New York, N. Y.

311,241. SAW-VISE.—Henry Flater, Findlay, O.

311,245. SKYLIGHT. — Eduard Henn, Jersey City, N. J.

311,248. CALIPERS. — Stewart A. Jellett, Philadelphia, Pa.

311,252. WINDOW.—Martin S. Millard, Kansas City, Mo.

311,253. DUMB-WAITER. — Stephen A. Morse, Philadelphia, Pa.

311,256. TRANSOM-LIFTER. — August F. Pfeifer, Newark, N. J.

311,271. DISINFECTING APPARATUS. — Russell Thayer, Philadelphia, Pa.

311,279. SAFETY-ATTACHMENT FOR ELEVATORS.— Arthur M. Baker, New York, N. Y.

311,288. SASH-FASTENER. — William Brown, Duncannon, Pa.

311,307. DOOR-SPRING. — William Gilfillan, New Haven, Conn.

311,309. DEVICE FOR RENDERING WOODEN HOUSES FIRE-PROOF.—John N. Glover, Chicago, Ill.

311,313. HOT-AIR HEATING APPARATUS.—John L. Hamilton, St. Joseph, Mo.

311,327. HYDRAULIC LIFT. — William H. Johnson, Westminster, County of Middlesex, Eng.

311,342. HOPPER WATER-CLOSET.—Henry W. Mansur, Boston, Mass.

311,366. SASH-FASTENER. — Benj. L. Rex, Lovettsville, Va.

311,369. ELEVATOR.—Samuel T. Richardson, Baltimore, Md.

311,386. SURVEYING-INSTRUMENT. —Chas. E. Taft, Chicago, Ill.

311,392. WEATHER-STRIP. — Gustavus G. Wagner, Mount Vernon, N. Y.

311,394. COMBINED ANVIL, VISE AND DRILL. — Jas. Weathers, Indianapolis, Ind.

311,401. PAINT.—William H. Wilber, Buffalo, N. Y.

311,442. LUMBER-DRIER.—Horace J. Morton, Pullman, Ill.

311,443. PORTABLE WATER-CLOSET. — Charles C. Nash, Providence, R. I.

311,448. SHUTTER-FASTENER. — John S. Ryan and John Conway, New York, N. Y.

SUMMARY OF THE WEEK.

Baltimore.

GUANO WORKS.—The Zell Guano Company are building entire new works, consisting of mill-building, acid-chambers, elevator, storage-shed, etc., to cost about $100,000, from designs by W. Claude Frederic, architect; P. A. Hause, superintendent; F. H. Smith, consulting engineer.

DWELLINGS.—W. Claude Frederic, architect, has prepared plans for Jacob Saum, builder, for 8 three-st'y and basement brownstone buildings (bay-window fronts), to be erected on s s North Ave., near Eutaw Pl., on lot 100′ x 140′, to cost about $32,000.

ADDITION. — St. Paul's Eng. Lutheran Church are to build a brick addition to Sunday-school building, to cost $2,500, from designs by W. Claude Frederic, architect.

BUILDING PERMITS. — Since our last report ten permits have been granted, the more important of which are the following: —

J. D. Mason, two-st'y brick warehouse, 131 McElderry's Wharf.

Isaac Eigengneer, 2 two-st'y brick buildings, e s Dallas St, s of Gough St.

Ch. Schultze, three-st'y brick building, s s Shakespeare St., between Bond St. and Broadway.

W. L. Stork, 22 three-st'y brick buildings, s s North Ave., between Bolton and Park Sts.

Thos. H. Hanson, 3 five-st'y warehouses, commencing n e cor. Lombard and Liberty Sts.

Lawrence Turnbull, 13 three-st'y brick buildings, n s Preston St., between Greenmount Ave. and Proctor Alley; 1 three-st'y and 15 two-st'y brick buildings, e s Greenmount Ave., between Hoffman and Preston Sts., and 21 two-st'y brick buildings on the e s, and 20 two-st'y brick buildings on the w s Wirt St., between Greenmount Ave. and Procter Alley.

The Labor Quotations remain unchanged.

Brooklyn.

BUILDING PERMITS. — *Bainbridge St.*, n s, 158′ w Reid Ave., two-st'y brick dwell., tin roof, wooden cornice; cost, $4,000; owner, Kate Acor, 187 Bainbridge St.; architect, Clarence Liniken; builders, Lewis Acor and C. Linikin.

Palmetto St., No. 80, s s, 350′ e Bushwick Ave., three-st'y frame (brick-filled) tenement, tin roof; cost, $4,000; owner and builder, David H. Scott, 762 Monroe St.; architect, Ernest Dennis.

Franklin Ave., e s, 75′ n Park Ave., three-st'y frame (brick-filled) tenement, tin roof; cost, $3,500; owner, August C. Hodderson, cor. Franklin and Park Aves.; architect, Mr. Harverson; builders, Mr. Collins and Williams Bros.

Bergen St., n s, 268′ e Clason Ave., three-st'y brick tenement, tin, gravel and felt roof; cost, $4,000; owner, etc., T. W. Swimm, 394 Gates Ave.

Sumner Ave., s w cor. McDonough St., four-st'y brick flat, tin roof; cost, $11,000; owner, W. A. Cuyck, 171 Stuyvesant Ave.; architect, Th. Engelhardt; builders, G. Lehman & Sons and M. Metzen.

Broadway, No. 791, e s, 25′ n Adams St., four-st'y brick store and tenement, tin roof; cost, $8,000; owner, J. M. Otto, 453 Grand St.; architect, Th. Engelhardt; builders, J. Rauch and J. Rueger.

Lynch St., n s, 122′ e Harrison Ave., three-st'y frame tenement, tin roof; cost, $4,000; owner and architect, Jno. Platte, 244 Lynch St.

Fourteenth St., n s, 197′ 10″ w Seventh Ave., 6 two-st'y brick dwells., tin roof, wooden cornice; cost, each, $3,800; owners, J. E. Skidmore —— Conhead; architect and carpenter, J. E. Skidmore; masons, Buchanan & Riley.

Meeker Ave., n w cor. Kingsland Ave., three-st'y brick store and tenement, tin roof; cost, $9,200; owner, Peter Ruger, 275 East Houston St., New York; architect, Leonard F. Graether; builder, John Fallon.

Adams St., No. 11, n s, 100′ e Broadway, four-st'y frame (brick-filled) tenement, tin roof; cost, $6,000; owner, William Goeller, Flushing Ave.; architect, Th. Engelhardt; builders, Ernst Loerch and John Rueger.

Stagg St., Nos. 275 *and* 277, n s, 225′ w Waterbury St., 2 three-st'y frame tenements, tin roofs; cost, each, $4,000; owner, Mrs. Chas. R. Baker, 244 Washington Ave.; architect, Th. Engelhardt; builders, John Auer and Peter Kunzweiler.

Tompkins Ave., w s, 25′ s Quincy St., 4 four-st'y brick stores and flats, tin roofs; cost, each, $9,500; owner and builder, Jas. W. Stewart, 373 Quincy St.; architect, M. Walsh.

Tompkins Ave., s w cor. Quincy St., four-st'y brick store and flat, tin roof; cost, $12,500; owner and builder, Jas. W. Stewart, 373 Quincy St.; architect, M. Walsh.

Quincy St., s s, 80′ w Tompkins Ave., two-and-a-half-st'y dwell., tin roof; cost, $5,500; owner and builder, Jas. W. Stewart, 373 Quincy St.; architect, M. Walsh.

Devoe St., n e cor. Leonard St., four-st'y frame factory, tin roof; cost, $7,500; owner, John C. Andresen, 304 Ewen St.; builder, C. Vincent.

Eighteenth St., n s, 320′ w Fifth Ave., 2 two-st'y brown-stone dwells., tin roofs; cost, each, $4,500; owners, M. A. Schneider and Daniel Ryan, 152 Nineteenth St. and 725 Third Ave.; architect, T. F. Houghton.

Broadway, Nos. 689 *and* 691, e s, 55′ n Ellery St., 2 four-st'y brick tenements, tin roofs; cost, $18,000; owner, Louis Stutz, 693 and 695 Broadway; architect, Th. Engelhardt; builder, John Aur and Jos. Wagner, Jr.

Cedar St., Nos. 50 *and* 52*a*, s s, 137′ 9″ e Evergreen Ave., 3 three-st'y frame (brick-filled) tenements, tin roofs; cost, each, $3,000; owners, C. & G. Spoerl, 44 Myrtle Ave.; architect, Th. Engelhardt.

ALTERATIONS.—*Grove St.*, n s, 183′ 4″ e Central Ave., raise 8 feet; cost, $3,500; owner and carpenter, P. M. Flood, on premises; architect, J. T. Miller; mason, H. O'Brien.

Chicago.

BUILDING PERMITS—M. H. McKillip, livery-stable, 199 and 201 Erie St.; cost, $3,000.

S. W. Rawson, 6 cottages, Taylor St.; cost, $6,000.

S. W. Rawson, 6 cottages, Fillmore and Harvard Sts.; cost, $6,000.

J. Halloren, two-st'y dwell., 3229 Lasalle St.; cost, $3,500.

A. Deluce, two-st'y flats, 3334 South Wood St.; cost, $3,500.

L. M. Giles, two-st'y dwell., 60 Oak St.; cost, $3,500.

Woodstone & Swanson, three-st'y dwell., 146 Centre St.; cost, $3,000.

S. Piggot, 3 two-st'y dwells., 200-204 Fremont St.; cost, $9,000; architect, S. Piggot.

F. D. Reynolds, two-st'y dwell., 53 Thirty-second St.; cost, $2,500.

New York.

FLATS. — At Nos. 228 and 230 East Forty-second St., a five-st'y flat, 50′ x 90′, is to be built at a cost of about $48,000, for Messrs. Gordon Bros.; from designs of Mr. A. Wagner.

On the s s of Eighty-fifth St. between Madison and Fourth Aves., a six-st'y apartment-house, 41′ x 92′, is to be built by Mr. P. Braender, with front of brick, stone and terra-cotta; from designs of Mr. John Brandt; and from designs of the same architect 8 five-st'y brown-stone flats, 25′ x 85′ each, are to be built by Mr. George Muller on the s e cor. of Eighty-fourth St. and Second Ave., at a cost of about $140,000.

At. Nos. 68, 70 and 72 Norfolk St., 3 five-st'y brick and stone tenements, 25′ x 85′ each, are to be built for Mr. S. J. Silberman, at a cost of $60,000; from plans of Mr. W. Graul.

FACTORY. — On the s s of Forty first St., e of Tenth Ave., a seven-st'y iron front building 75′ x 75′, is to be erected for Mr. P. Pyribil, at a cost of about $50,000; from designs of Mr. Albert Wagner.

BUILDING PERMITS. — *Fifty-fifth St.*, n w corner Eleventh Ave., five-st'y brick tenement and store, tin roof; cost, $18,000; owner, James Brooks, 373 West Fifty-sixth St.; architect, John F. Wilson.

Eleventh Ave., w s, 25′ 5″ n Fifty-fifth St., five-st'y brick tenement and store, tin roof; cost, $14,000; owner and architect, same as last.

Twenty-second St., n s, 117′ 4″ w Ave. A, five-st'y brick warehouse and factory, gravel roof; cost, $25,000; owner, Carl H. Schultz, 76 University St.; architect, Ed. E. Raht.

Seventy-second St., n s, 51′ 2″ e First Ave., five-st'y brick tenement, tin roof; cost, $15,000; owners, Ph. and Wm. Ebling, St. Anns Ave. and One Hundred and Fifty-sixth St.; architects, Pfund & Son.

Seventy-second St., n s, 76′ 6″ e First Ave., 2 five-st'y brown-stone front tenements, tin roofs; cost, each, $12,000; owner and architect, same as last.

Bleecker St., No. 95, six-st'y brick warehouse, tin roof; cost, $50,000; owner, Joseph Andrade, London, Eng.; architects, Alfred Zucker & Co.

East Forty-third St., No. 203, five-st'y brick tenement and store, tin roof; cost, $15,000; owners, Hartley and Wm. Haigh, 139 East Forty-third St.; architects, D. & J. Jardine; builder, Wm. Haigh.

Ninety-second St., n s, 130′ w Fourth Ave., three-st'y brown-stone front dwell., tin roof; cost, $15,000; owner, Jacob Wicks, Sr., 508 East Eighty-seventh St.; architect, John Brandt.

One Hundred and Forty-sixth St., n s, 400′ e Tenth Ave., two-st'y brick dwell., tin roof; cost, $7,000; owner, Clifford Barbee, 207 West Fourteenth St., architect, Henry Fouehaux.

Franklin St., No. 184, six-st'y brick tenement, tin roof; cost, $12,000; owner, Louis Meyers, on premises; architect, Louis Meystre.

West Forty-eighth St., No. 402½, five-st'y brick tenement, tin roof; cost, $5,000; owner, Simon Kay, 353 West Forty-eighth St.: architect, M. C. Merritt.

Delancey St., s s, 25′ w Sheriff St., 2 five-st'y brick tenements, tin roofs; cost, each, $12,000; owner, Mark Rinaldo, 220 East Thirty-third St.; architects, A. B. Ogden & Son.

Norfolk St., Nos. 116 *and* 118, 2 five-st'y brick tenements, tin roofs; cost, each, $14,000; owner, Jacob Raichle, 227 William St.; architect, Julius Boekell.

Ninth Ave., n w cor. Ninety-fourth St., and s w cor. Ninety-fifth St., 2 four-st'y brick tenements and stores, tin roofs; cost, each, $14,000; owner, John M. Pinkney, 716 Madison Ave.; architect, J. H. Valentine.

Ninth Ave., w s, 22′ n Ninety-fourth St., 8 four-st'y tenements and store, tin roofs; cost, each, $13,000; owner and architect, same as last.

East One Hundred and Fifty-second St., No. 628, three-st'y brick and frame tenement, tin roof; cost, $5,000; owner and builder, Mattheus Meusch, on premises; architect, Chas. W. Miller.

Houston St., s e cor. Crosby St., seven-st'y brick warehouse and factory, tin roof; cost, $85,000; owners, G. Sidenberg & Co., 49 Mercer St.; architects, Alfred Zucker & Co., 346 Broadway.

ALTERATIONS.—*One Hundred and Twenty-ninth St.*, n w cor. Tenth Ave., four-st'y brick extension to Grammar School, tin and slate roof; cost, $85,000; owner, City of New York, S. A. Walker, President Board of Education, 8 East Thirtieth St.; architect, D. J. Stagg, 146 Grand St.: builder, Joseph Spears.

Third Ave., e s, 200′ n One Hundred and Sixty-ninth St., four-st'y extension (on front) to Grammar School No. 61, tin and slate roof; cost, $85,000, owner and architect, same as last; builder, Thos. Overington.

Thomas St., Nos. 11 *and* 13, *and* 82 *and* 84 Worth St., three-st'y brick extension, iron and glass roof; cost, $4,000; owner, New York Real Estate Association, G. P. Slade, treasurer, 110 Leonard St.; architect, Richard Berger; builder, Wm. Slade.

Third Ave., No. 1515, three-st'y brick extension, tin roof; cost, $5,000; owner, Louis Braecht, 1493 Third Ave.; architect, John Brandt.

West Fifty-third St., No. 45, repair damage by fire; cost, $5,000; owner, estate John S. Giles, 174 Canal St.; builders, James Hamel & Son.

Broadway, Nos. 177 *and* 179, take out part of centre wall on each floor to connect building, rearrange rooms, new stairs, elevator; cost, $20,000; owner, Geomania Fire Insurance Co., 175 Broadway; architect, Ferdinand Fish; builders, L. N. Crow and Hamilton & Henry.

Broadway, No. 697, five-st'y brick extension (on lots 693 and 695 Broadway), tin roof; cost, $30,000; owners and architects, Maclay & Davies. 120 and 697 Broadway; builders, Wm. Haigh and James H. Banta.

Philadelphia.

Germanton Ave., No. 3046, three-st'y store, 14′ x 50′; Gottlieb Blenzinger, contractor.

Sumac St., e of Ridge Ave., two-st'y store and dwell., 18′ x 60′; A. A. Harmer, owner.

St. Louis.

BUILDING PERMITS. — Fourteen permits have been issued since our last report four of which are for unimportant frame houses. Of the rest, those worth $2,500 and over are as follows: —

C. F. Buermann, two-st'y double dwell.; cost, $2,500; W. W. Love, contractor.

C. F. Buermann, 3 adjacent two-st'y dwells.; cost, $3,000; W. W. Love, contractor.

Monk, three-st'y stores and tenements; cost, $3,000; G. I. Barnett, architects; sub-let.

Jno. B. Link, two-st'y dwell.; cost, $3,000; J. H. Frye, contractor.

E. Beggemon, double two-st'y brick dwell.; cost, $4,000; C. Sinnentkohl & Co., coutractors.

Mrs. D. Poertner, 2 adjacent two-st'y dwells.; cost, $3,500; C. H. Poertner, contractor.

General Notes.

CHARLESTON, S. C. — The following permits were issued during the month of January, 1885, for the erection of new buildings and the improvement of old buildings in the city: —

New buildings, 40 permits; reported cost, $34,075.

Old buildings improved, 9 permits; reported cost, $4,050.

Total permits for January, 1885, 49; total cost, $38,125.

The report for the same period of 1884 was 43 permits, and the reported cost, $27,275.

Mr. W. F. Carter has a contract to build 7 houses for Mr. S. J. L. Matthews, 2 at the cor. of Tradd and Friend Sts., and 5 on the cor. of Tradd and Limehouse Sts.

EAU CLAIRE, WIS. — Architect Radcliff of St. Paul has been selected by Rev. Father Collins, of St. Patrick's Church, to execute the plans for the new church to be erected the coming season.

ELLENDALE, DAK. — A public meeting has been held at Ellendale, and a bonus of $25,000 in promises and land offered for the location of the peripatetic capital at that place.

HASTINGS, MINN. — Arrangements have been made and contracts signed for the buildings of a large pork packing establishment on the river front at Hastings. It will be ready for use next fall.

NEWPORT, R. I. — The City of Newport, R. I., have accepted plans for fire engine-house and ward room, to be located in Third Ward; S. S. Ward, architect, Boston.

RED WING, MINN. — Among the many residences to be built the coming summer is a costly one by Hon. William Eisenbrand.

ROCHESTER, N. Y. — Plans are being prepared for a malt-house for the Genesee Brewery, to be built cor. of Race and Cataract Sts, its cost, $25,000; O. Knebel, architect.

The recent jail competition-work of preparing plans, has been awarded to Warner & Brockett architects; building to cost, $67,000.

PROPOSALS.

COURT-HOUSE.

[At Clarinda, Io.]

CLARINDA, Io., January 9, 1885.

Sealed Proposals for building a court-house at Clarinda, Page County, Io., will be received at my office **until 12 o'clock, noon, Wednesday, February 18th, 1885.** Plans and specifications will be on file at the court-house in Clarinda, on and after February 1, and may be seen prior to that time at the office of Foster & Liebbe, Architects, Des Moines Io.

The right is reserved to reject any or all bids.

By order of the Board of Supervisors.

477 R. H. LYMER, Auditor.

IRON-WORK.

[At Great Kanawha River, W. Va.]

U. S. ENGINEER OFFICE, 378 ST. PAUL ST., BALTIMORE, MD., January 24, 18-5.

Proposals for the iron-work of the pass of a movable dam on the Great Kanawha River, West Virginia, four miles below Charleston, embracing about 130,000 pounds of wrought, and 97,000 pounds of cast-iron, will be received at the U. S. Engineer Office, Charleston, Kanawha County, West Virginia, **until noon of February 14, 1885,** and opened immediately thereafter.

Specifications can be had upon application to Mr. A. M. Scott, Assistant Engineer at Charleston. Drawings will be exhibited and all necessary information given at the Charleston office.

WM. P. CRAIGHILL,

477 Lt.-Col. of Eng'rs, U. S. Army.

COURT-HOUSE.

[At Farmington, Me.]

January 26, 1885.

Sealed proposals will be received at the Clerk of Courts Office, Farmington, Me., **until 12 o'clock,** M., **Tuesday, February 17, 1885,** for furnishing the materials and erecting a court-house for Franklin County, at Farmington, Me.

Plans and specifications may be examined and all information obtained at the Clerk's office in Farmington and at the office of G. M. Coombs, architect, Lewiston, Me.

Proposals will be received for the whole or a part of the work and materials.

The right is reserved to reject any or all bids.

F. W. PATTERSON, ISAIAH CHICK, S. K. WELLMAN, County Commissioners.

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COURT-HOUSE ALTERATIONS.

[At Preston, Minn.]

PRESTON, January 9, 1885.

The County Commissioners of the County of Fillmore, in the State of Minnesota, will receive sealed proposals **until the 25th day of March, 1885, at 12 o'clock,** M., at the office of the county auditor, in the village of Preston, said county, for the remodeling of the county court-house in said village, and the building of 2 two-st'y brick additions thereto, and iron vaults therein, and the furnishing all materials, in accordance with the plans and specifications therefor on file in the office of said auditor, which can also be seen at the office of Mayberry & Son, architects, Winona, Minnesota.

No bids will be received except for the whole building complete as specified.

The successful bidder will be required to give a sufficient bond with sureties, within a reasonable time to be fixed by said commissioners, in the sum of $15,000, to be approved by said commissioners, conditioned upon the faithful performance of his contract.

Each bid must be accompanied by a sufficient bond with sureties, or a duly certified check payable to said county in a sum of at least five per cent of such bid, conditioned upon the giving the bond above specified within the time so fixed, provided such bid should be accepted. The work will cost several thousand dollars, and must be completed on or before the first day of November, 1885. Right reserved to reject any or all bids.

J. G. MINER,

Chairman Board of County Commissioners.

Attest: G. A. HAYES, County Auditor.

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PROPOSALS.

JAIL.

[At Scranton, Pa.]

OFFICE OF THE COMMISSIONERS OF LACKAWANNA COUNTY, SCRANTON, PA., January 24, 1885.

Sealed proposals for the erection and completion of a county jail for Lackawanna County, to be located on the corner of Washington Ave. and New York St., in the city of Scranton, Pa., will be received by the undersigned Commissioners of said county, at their office **until Thursday, February 26, 1885, at 10 o'clock in the forenoon.** Plans and specifications will be on file at the court-house in the city of Scranton, on and after Tuesday, January 27, 1885. The builder to whom the contract shall be awarded will be required to enter into bonds with at least two approved sureties for the sum of $20,000, for the faithful performance of the contract. Work to be commenced within thirty days after the awarding of the contract, and to be finished on or before April 1, 1887.

The Commissioners reserve the right to reject any or all bids.

WM. FRANZ, H. L. HALSTEAD, WM. J. BURKE, County Commissioners.

Attest: D. W. POWELL, Clerk. 478

SCHOOL-HOUSE.

[At Morgan, O.]

Sealed proposals will be received by the Board of Education of Morgan Township, Butler County, O., for the building of a brick school-house in Sub-District No. 4, of said Township, **until 12 o'clock, noon, of the 12th day of February, 1885.**

Said board reserves the right to reject any or all bids.

Plans and specifications can be seen at the Township Clerk's Office in Okeana. 476

IRON WATER-PIPE.

[At Providence, R. I.]

BOARD OF PUBLIC WORKS, OFFICE, CITY-HALL, PROVIDENCE, R. I., January 27, 1885.

Sealed proposals will be received at this office **until 11 o'clock,** A.M., **Tuesday, February 10, 1885,** for furnishing the following sizes of cast-iron water-pipes.

Five hundred tons of 2240 pounds, six inches in diameter.

Three hundred tons of 2240 pounds, eight inches in diameter.

To be delivered on wharf in this city.

The delivery to commence on or before May 1, and to be completed on or before August 1, 1885.

A bond satisfactory to the Board in the sum of eight hundred dollars, as liquidated damages, for failure to execute the contract within ten days, if awarded, will be required of each bidder, and a satisfactory bond in the sum of five thousand dollars conditioned upon the faithful fulfilment of the contract, will be required of the successful bidder.

Specifications and forms of contract and of proposals may be obtained on application at this office.

The Board reserve the right to reject any or all bids.

CHAS. E. CARPENTER, CLINTON D. SELLEW,

476 Board of Public Works.

CAST-IRON WATER-PIPES.

[At Boston, Mass.]

CITY OF BOSTON, CITY HALL, BOSTON WATER BOARD OFFICE, Jan. 29, 1885.

Sealed proposals will be received at this office **until 12 o'clock,** M., **of Thursday, the 12th day of February, 1885,** to be endorsed "Proposals for Cast-Iron Water-Pipes for the Cochituate Department," and at that time and place they will be publicly opened and read.

Bidders are required to state in their proposals their names and places of residence.

Each bid must be signed by the bidder and accompanied by a written bond of a responsible person, giving his place of business or residence, and conditioned for the execution of the contract (with satisfactory security for its performance) within the time specified in this advertisement in case the bid be accepted, or in lieu of the bond aforesaid, a sum of money or other satisfactory collateral security in the same amount may be deposited with said Water Board.

The amount of the bond required with the bid is $500.

The person to whom the contract may be awarded will be required to execute the contract within four days (not including Sunday) from the date of notification of such award and the preparation and readiness for signature of the contract.

The delivery of the pipes on each contract to commence on or before April 15, 1885, and to be completed on the 15th day of August, 1885.

The estimate of quantities required and by which the bids will be compared is as follows: —

20 tons 4-inch pipe, class B.
520 tons 6-inch pipe, class B.
425 tons 8-inch pipe, class B.
165 tons 12-inch pipe, class A.
700 tons 12-inch pipe, class B.
120 tons 16-inch pipe, class A.
70 tons special castings.

Specifications may be obtained and plans seen at the office of the City Engineer, City Hall, Boston.

The amount of security required will be such sum as may be fixed by the Water Board after the proposals are opened; said sum not to be less than one-fourth nor more than one-half of the amount of the contract.

The sureties of the bond for the contract must be residents of Massachusetts.

The Water Board reserves the right to reject any or all proposals, should it deem it to be for the interests of the city of Boston so to do. 476

PROPOSALS.

STONE AND BRICK WORK, ETC.

[At Erie, Pa.]

OFFICE OF SUPERVISING ARCHITECT, TREASURY DEPARTMENT, WASHINGTON, D. C., January 27, 1885.

Sealed proposals will be received at this office **until 2 P. M., on the 28th day of February, 1885,** for furnishing and setting all the stone and brick work for the superstructure of the court-house, post-office, etc., at Erie, Pa., in accordance with specifications and drawings, copies of which may be seen and any additional information obtained at this office or the office of the local superintendent of the building.

Bids must be accompanied by a certified check, and those received after the time of opening will not be considered. M. E. BELL,

476 Supervising Architect.

CARPENTRY.

[At Cincinnati, O.]

OFFICE TRUSTEES TO REBUILD COURT-HOUSE, HAMILTON COUNTY, OHIO, CINCINNATI, January 21, 1885.

SOUTH COURT-HOUSE YARD.

Sealed proposals will be received at this office **until 9 1-2 o'clock,** A. M., **on Saturday, February 7, 1885,** for furnishing the carpenter and joiner work in rebuilding the court-house in Hamilton County, O., according to plans and specifications on file at this office and at the office of James W. McLaughlin, architect, Nos. 46 and 47 Johnston Building. The bids must be made on the blanks that will be furnished on demand by said Board.

The Board reserves the right to reject any and all bids. By order of the Board.

479 J. CLIFFORD GOULD, Clerk.

STONE AND BRICK WORK.

[At Lynchburgh, Va.]

OFFICE OF SUPERVISING ARCHITECT, TREASURY DEPARTMENT, WASHINGTON, D. C., January 27, 1885.

2 P. M., on the 26th day of February, 1885, for furnishing the labor and material, bricks, terra-cotta, stone, mortar, etc., and building complete the masonry of the walls of basement and superstructure of the court-house, post-office, etc., building at Lynchburgh, Va., in accordance with drawings and specifications, copies of which may be seen and any additional information obtained on application at this office or the office of the superintendent.

Bids must be accompanied by a certified check, and those received after the time of opening will not be considered. M. E. BELL,

476 Supervising Architect.

ROLLED-IRON BEAMS AND PLATE GIRDERS.

[At Washington, D. C.]

OFFICE OF BUILDING FOR STATE, WAR AND NAVY DEPARTMENTS, WASHINGTON, D. C., January 22, 1885.

Separate sealed proposals for furnishing and delivering the rolled-iron beams and sixteen plate girders required for four floors of the west and centre wings of the Building for the State, War and Navy Departments in this city will be received at this office **until 12 M., on February 17, 1885,** and opened immediately thereafter, in presence of bidders.

Specifications, general instructions to bidders, and blank forms of proposal, for either the beams or the girders, will be furnished to established manufacturers on application to this office.

THOS. LINCOLN CASEY,

476 Colonel, Corps of Engineers.

LABOR AND MATERIALS.

[At Harrisonburg, Va.]

OFFICE OF SUPERVISING ARCHITECT, TREASURY DEPARTMENT, WASHINGTON, D. C., January 10, 1885.

Sealed proposals will be received at this office **until 2 o'clock,** P. M., **on the 24th day of February, 1885,** for furnishing all the labor and materials, including stone, bricks, woodwork, etc., required for the construction of the court-house, etc., building at Harrisonburg, Va., in accordance with drawings and specifications, copies of which, and any additional information may be obtained on application at this office or the office of the superintendent, on and after January 23, 1885.

Bids must be accompanied by a certified check, and those received after the time of opening will not be considered. M. E. BELL,

476 Supervising Architect.

COURT-HOUSE.

[At Troy, O.]

AUDITOR'S OFFICE, TROY, MIAMI CO., O., January 3, 1885.

Sealed proposals will be received at this office **until 12 o'clock, noon, of February 11, 1885,** for furnishing all the material and performing the labor necessary to erect a new court-house at Troy, in said County, according to plans and specifications on file at this office.

Bids must be made according to law, and must be accompanied by a bond (to be approved by the Board of Commissioners) for at least twenty-five per cent of the amount of the bid; the bond to be conditioned that if work is awarded, a proper bond and contract will be entered into.

The Commissioners reserve the right to reject any or all bids.

Blanks for bids and bonds can be had at this office, or at the office of J. W. Yost, architect, at Columbus, O.

Bids must be endorsed "Bid for Court-House," and addressed to HORATIO PEARSON,

476 County Auditor, Troy, O.